ELECTRICAL WORLD

A McGRAW-HILL PUBLICATION

FEBRUARY 12, 1949

ELECTRICAL WORLD 1874 1949 OUR 75TH YEAR

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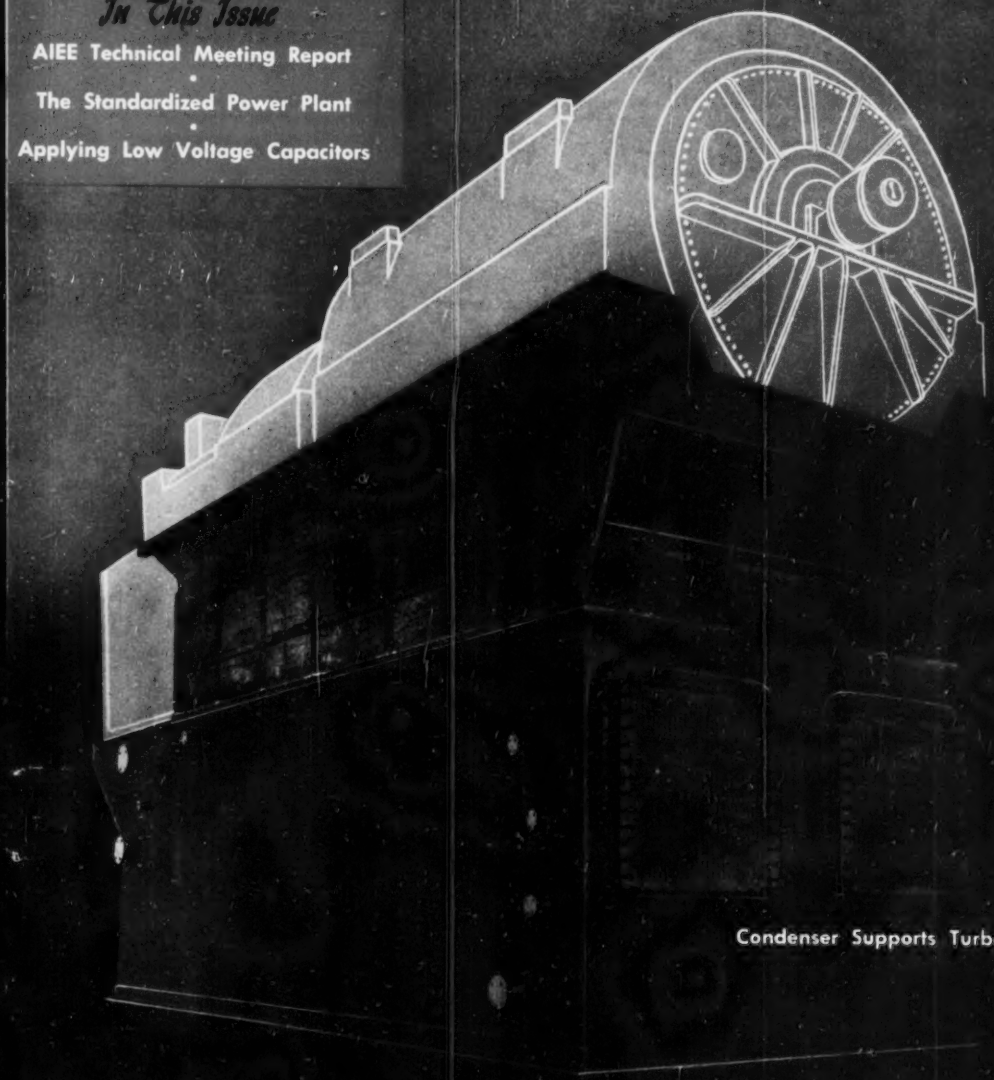
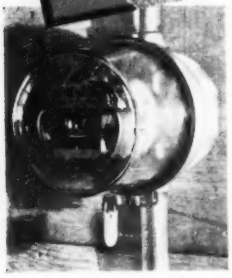


Condenser Supports Turboalternator

NOW Murray GIVES you REVERSIBLE JAWS

IN SOCKET METER CASES — *for* VERTICAL *or* HORIZONTAL MOUNTING

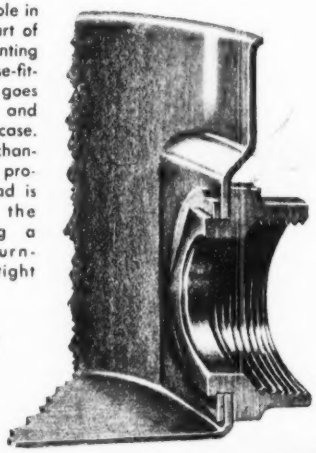


THIS newest Murray feature—and the pictures show how simple it is—vastly increases the use of these socket meter cases, drawn of 3 So aluminum. The speed with which the reversal can be made, commends it to all electricians; and the fact that the same case does equally well for vertically or horizontally mounted meters, reduces the stock which dealers must carry.

HOW the heavy HUB is permanently SEALED in!

THE hex end of the hub fits a hex hole in the flattened part of the case, preventing turning. A close-fitting hex washer goes over the hub and rests against the case. By ingenious mechanical means, the protruding hex head is flared over the washer, making a permanent, turn-proof, water-tight seal.

Send for Bulletin 503



another Murray specialty—

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ELECTRICAL WORLD

Published for 75 years for those engaged in the business of generating, transmitting, distributing or applying electric power

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COVER PICTURE—Condenser of novel power unit is reinforced so that its shell can support the turboalternator in an intermediate cradle. No concrete "island" is necessary. Adapted by Burns and Roe, Inc, from Foster Wheeler Corp photograph

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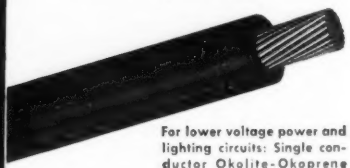
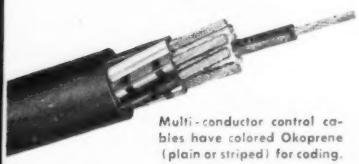
WHY STATIONS HAVE STANDARDIZED ON OKOLITE-OKOPRENE CABLES

Okolite-Okoprene generator lead: Semicon tape protection over segmental conductor, heavy wall of Okolite insulation, metal shielding tape and non-flammable, non-metallic Okoprene sheath.



For lower voltage power and lighting circuits: Single conductor Okolite-Okoprene wire.



Multi-conductor control cables have colored Okoprene (plain or striped) for coding.

PROPERTIES	LOCATIONS	OKOLITE-OKOPRENE PROPERTIES
LONG LIFE AND RELIABILITY	All electrical circuits.	Confirming nearly a quarter-century of field experience, continuous aging tests of Okolite insulation checked at intervals in Okonite's proving ground, show practically no change in physical and electrical characteristics. Okolite oil-base insulation, applied by Okonite's strip process, is made with wild Up-river Fine Para rubber established over many years of steady use as stable and dependable. Exposure tests and service records over 13 years have proved the durability of Okoprene coverings.
ELECTRICAL STABILITY	All control, power, lighting, and switchboard circuits.	Electrical measurements made on Okolite insulation after 8 years immersion in water show the insulation resistance unchanged from the excellent values recorded in the first 6 months. Insulations made with synthetic rubbers show no such stability. Retention of Okolite's stable electrical qualities is further insured by the Okoprene sheath that seals the insulation from terminal to terminal.
HIGH DIELECTRIC STRENGTH AND OZONE RESISTANCE	Generator and transformer leads, auxiliary power circuits, test cables, etc.	Okolite's high dielectric strength is greatly increased by the use of Semicon tape over conductors operating above 2000 volts. Therefore, in addition to a-c. tests at voltages 25% greater than IPCEA requirements, all such Okolite-Okoprene cables are also given a self-imposed d-c. kenetron test at 3 to 4 times the IPCEA 60-cycle a-c. values. Internal and external ozone attack is resisted in 4 ways: (1) Okolite insulation is ozone-resistant, (2) Semicon tape prevents internal corona discharge, (3) Okoprene covering is not only ozone-resistant but (4) does not develop static discharge below 5000 volts.
MOISTURE RESISTANCE	Cables in ducts, troughs, or buried direct and wherever condensation exists.	Okolite insulation—*without any lead covering*—has been used for 20 years in submarine power cables, some of which operate at 35,000 volts. From its Okoprene sheath that cannot rot to its conductor coated with Okoloy—the lead alloy that outlasts tinning 2 to 1—an Okolite-Okoprene cable resists attack by moisture.
HEAT AND FLAME RESISTANCE	Boiler rooms, tunnels, and other hot locations and for heavily-loaded cables.	Okolite insulation, recommended for use at 75 degrees C up to 8000 volts and 70 degrees C above 8000 volts, is suitable for heavy current loadings or for hot locations. Since equally heat-resistant Okoprene coverings will not support combustion, Okolite-Okoprene cables are also non-flammable, a feature of prime importance in station design.

LOW COST INSTALLATION AND OPERATION

The complete simplicity of Okolite-Okoprene cables reduces weights and handling problems to a minimum and eliminates corrosion and electrolysis since no lead sheath is required. Splicing and terminating methods are also greatly simplified as potheads, lead sleeves and filling compounds are unnecessary.

Okolite-Okoprene station wires and cables are available in a complete range of designs from switchboard wire and control cables to heavy, shielded generator leads of the largest dimensions. Okolite-Okoprene cables may be installed in conduit, on trays or racks, buried direct or exposed to the weather. For complete information, including current carrying capacities, dimensional data and splicing instructions ask your Okonite representative for Okolite-Okoprene Folder File or write direct to The Okonite Company, Passaic, New Jersey.

OKONITE SINCE 1878 insulated wires and cables

THE BEST CABLE IS YOUR BEST POLICY

Everything for your pole lines
Via GraybaR

. . . smoothly
. . . swiftly
. . . securely

Versatile Trucks

From Graybar you can get performance-proved FWD trucks, equipped as you wish for any line construction or maintenance job — with digger, derrick, or winch. Your choice of body styles and sizes. Trailers and dinkies also are a part of Graybar's full-range line.

TIME-SAVING TOOLS

Graybar has all the specialized tools you need to speed pole-line jobs. You can't do better than the Leach "Oshkosh" line of shovels, spoons, peavies, pikes, tampers. Simplex pole jacks, "American" Manila rope, and Coffing hoists are popular items, too. Also, tree trimmers, saws, shears.

"pliers to pockets"

All the smaller hand tools your linemen need are stocked by Graybar, too. Klein's pliers (all types), wrenches, grips, sleeve clamps, knives, safety straps, and combination tool pockets are linemen's favorites. Everything to make and keep your lines secure!

Local Deliveries

Many pole-line tools (including special types for hot-line work) and complete safety equipment are available from Graybar warehouses in almost a hundred cities. Whatever your pole-line requirements, the near-by Graybar Representative very likely can save you time in getting them together — and he'll make sure they're delivered when and where they're needed. A Graybar Outside Construction Specialist can help you solve any problem "from the bottom of the hole to the top of the pole". 4334

IN NEARLY 100 PRINCIPAL CITIES

SOUND CONSTRUCTION ASSURES

LONGER SERVICE LIFE

FROM TIREX PORTABLE CABLES

Simplex-TIREX Portable Electric Cables are carefully designed with an eye opened wide to the exacting and, very often, abusive conditions under which they must work. Toughness, flexibility, and safety are given top consideration and the result is a cable construction suited to day-in, day-out operation wherever the going is tough.

Check the advantages of this construction now. Keep them in mind. And next time you need cables for use on any portable electric equipment from hand tools to heavy shovels, remember to specify TIREX and profit by the dependable, low-cost cable service these features provide.

Conductors of TIREX Cables consist of small copper wires properly stranded together to provide non-kinking flexibility.

Conductor Insulation is a rubber compound having stable electrical properties and the mechanical strength necessary to withstand rough usage.

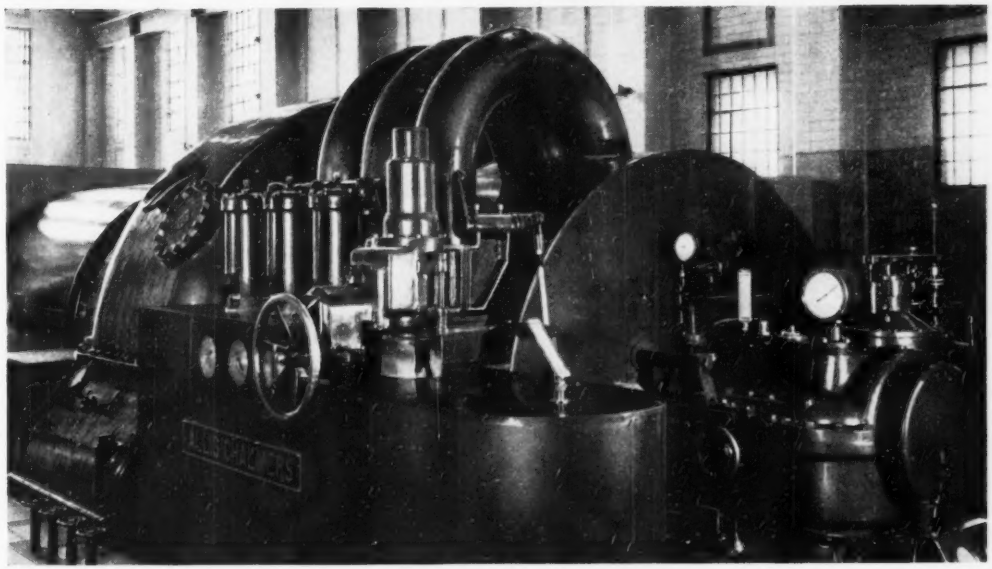
An **Inner Jacket** of durable rubber applied over the assembled insulated conductors forms the inner part of a tough protective covering for TIREX Cables. It provides a cushion for the conductors and protects them from mechanical shock whenever a cable is twisted or crushed.

Two **Seine Twine Serves,** hard-twisted for strength, are wound over the inner jacket to reinforce the protective covering and give it added wearability.

An **Outer Jacket** of Selenium Neoprene completes the construction. During vulcanization it is fused with the inner jacket and seine twine serves to produce a single, reinforced covering that is unexcelled for protection against abrasion, corrosive chemicals, weather hazards, sunlight, heat, and flame. It is not easily cut or worn and assures safe handling.

Simplex-Tirex

SIMPLEX WIRE & CABLE CO., 79 SIDNEY ST., CAMBRIDGE 39, MASS.



GET BETTER PROTECTION FOR YOUR TURBINES

Service them with Texaco Regal Oils (R&O) ...the oils with the extra margin of safety

IF *your* turbines—like so many throughout the country today—are running continuously under heavy load to meet higher power demands, they need the *extra* protection of *Texaco Regal Oils (R & O)*.

Texaco Regal Oils (R & O) are fortified with highly effective rust and oxidation inhibitors, and are processed to prevent foaming. Thus you get longer oil service life, and lubricating systems stay *clean*, assuring full protection for bearings, instantly responsive governor action—*an extra margin of safety* for your turbines!

Turbine manufacturers recommend the use of *inhibited* oils . . . and *Texaco Regal Oils (R & O)* meet the stringent requirements of all leading turbine builders, as well as the turbine oil specifications of the U. S. Navy.

A Texaco Lubrication Engineer will gladly work with you to increase operating efficiency and economy throughout your plant. Call the nearest of the more than 2300 Texaco Wholesale Distributing Plants in the 48 States, or write The Texas Company, 135 East 42nd Street, New York 17, N. Y.

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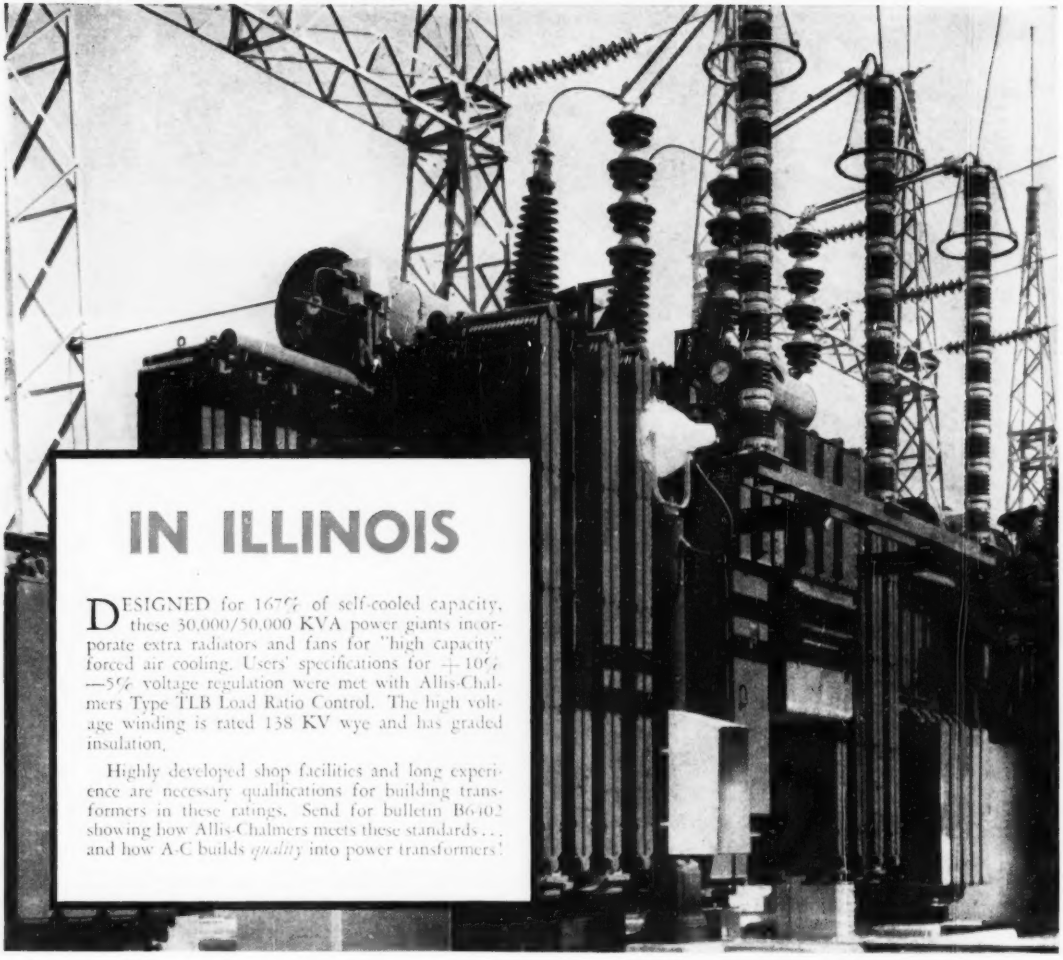
TEXACO Regal Oils (R&O)

FOR ALL TURBINES

Tune in...TEXACO STAR THEATRE presents MILTON BERLE every Wednesday night. METROPOLITAN OPERA broadcasts every Saturday afternoon.

Power Transformers



IN ILLINOIS

DESIGNED for 167% of self-cooled capacity, these 30,000/50,000 KVA power giants incorporate extra radiators and fans for "high capacity" forced air cooling. Users' specifications for +10% —5% voltage regulation were met with Allis-Chalmers Type TLB Load Ratio Control. The high voltage winding is rated 138 KV wye and has graded insulation.

Highly developed shop facilities and long experience are necessary qualifications for building transformers in these ratings. Send for bulletin B6402 showing how Allis-Chalmers meets these standards . . . and how A-C builds *quality* into power transformers!

A-C ...means Quality Power Transformers

Circular coils withstand high stresses. Coils are rigidly braced, vacuum dried and treated.

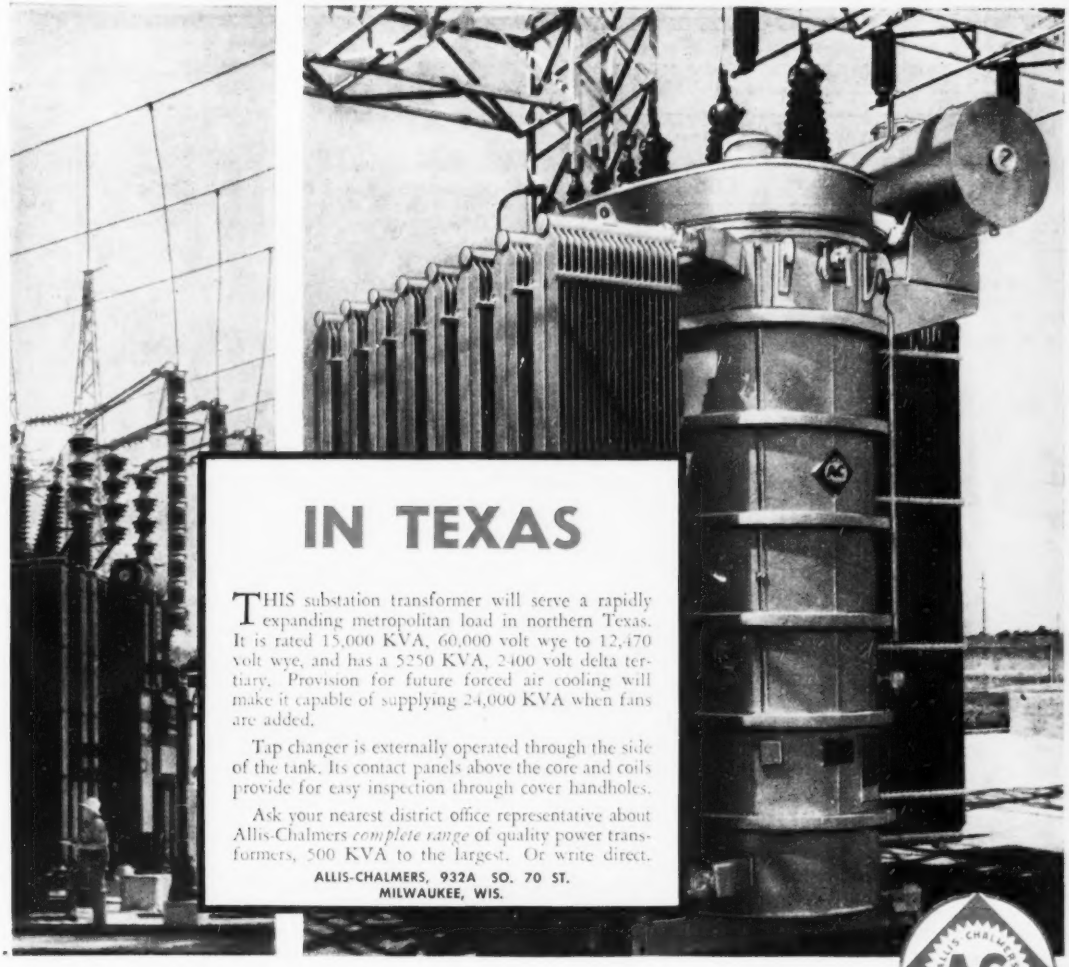
"Capacity Tailored" Load Ratio Control, featuring Allis-Chalmers 32-step regulation.

Controlled gasket compression insures correct pressure . . . increases life, effectiveness.

Strong, fin-type radiators rigidly braced. Staggered construction simplifies repainting.

Proved Oil-Sealed Inert Gas Protection provides simple, positive oil preservation.

"ON THE LINE!"



IN TEXAS

THIS substation transformer will serve a rapidly expanding metropolitan load in northern Texas. It is rated 15,000 KVA, 60,000 volt wye to 12,470 volt wye, and has a 5250 KVA, 2400 volt delta tertiary. Provision for future forced air cooling will make it capable of supplying 24,000 KVA when fans are added.

Tap changer is externally operated through the side of the tank. Its contact panels above the core and coils provide for easy inspection through cover handholes.

Ask your nearest district office representative about Allis-Chalmers *complete range* of quality power transformers, 500 KVA to the largest. Or write direct.

ALLIS-CHALMERS, 932A SO. 70 ST.
MILWAUKEE, WIS.

ALLIS-CHALMERS

A 2622

Pioneers in Power and Electrical Equipment From Generation Through Utilization

Select from Complete Line OF STANDARD RATINGS!

KVA	4800 VOLT AND BELOW	7200 VOLT AND UP
3-25	—	CBS-1
3-100	PBS	CBS
167-500	CBS	CBS

KEY TO TYPE DESIGNATION

CBS-1 Single high voltage cover bushing with low voltage stud bushings in tank wall.

PBS High voltage pocket bushings with low voltage stud bushings in tank wall.

CBS High voltage cover bushings with low voltage stud bushings in tank wall.

Type CBS-1 Type PBS Type CBS

Allis-Chalmers Distribution Transformers

EVERY RATING AND DESIGN of distribution transformer listed in the Fourth Report (1948) of EEI-NEMA can be supplied by Allis-Chalmers!

Size and weight of these transformers have been reduced as much as 1/3, making them easier to handle during installation.

All tanks are given Spra-Bonderized surface treatment . . . a hot dip phosphate process which protects against corrosive atmospheres.

Heavy gauge steel tanks are seam welded and pressure tested at 50 psi. to insure permanent protection against leaks.

For more details about these and other features of Allis-Chalmers distribution transformers, ask your nearby sales representative for the complete 12-point construction story. Or write for bulletin 6159A. A 2657

ALLIS-CHALMERS, 932A SO. 70 ST.
MILWAUKEE, WIS.

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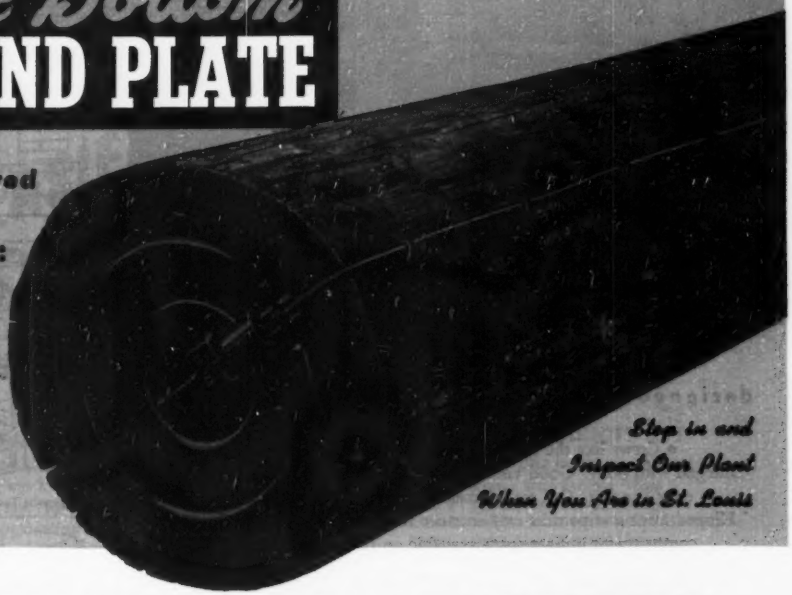
Pioneers in Power and Electrical Equipment From Generation Through Utilization

New! Improved!..

BLACKBURN *Pole Bottom* GROUND PLATE



REA Approved

How to Order:

See your Jobber and specify BLACKBURN Pole Bottom Ground Plate.

Catalog Number GP-100
(Made in 1 size only)

Shipping Weight: 40 lbs. per 100

Patented

Step in and Inspect Our Plant When You Are in St. Louis

3 BIG QUALITY FEATURES!

1. Supplied with double bar connector (one bar on each side of plate). These double bars grip wire tightly and positively—ground wire will not pull off or loosen as pole is set in hole.

2. It's stronger—more rigid—easier to handle—easier to store—easier to install—send for sample and see for yourself!

3. Connector screws are made of high strength Duronze—will not season crack—can be installed tightly without stripping or distorting.

You get all these features and others too—at no additional cost—so specify BLACKBURN Pole Bottom GROUND PLATES!

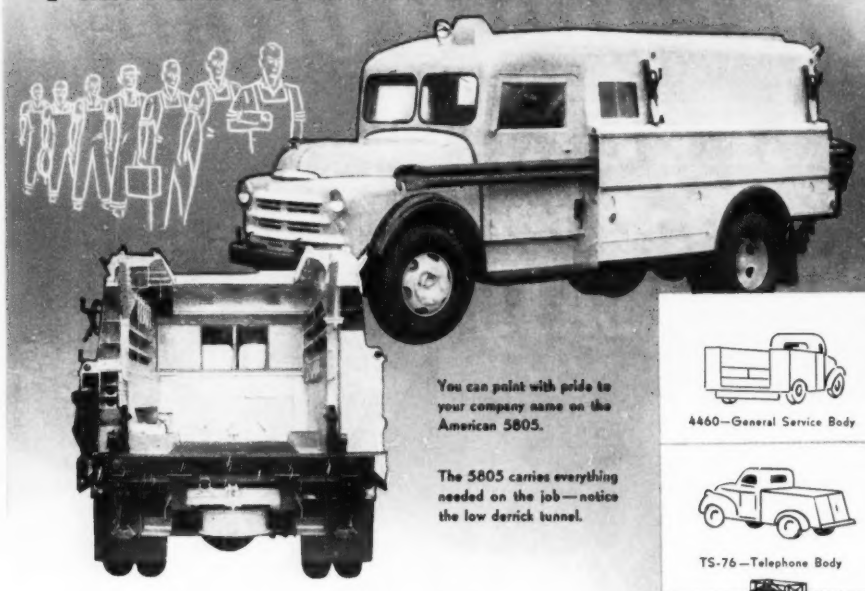
SEND FOR A SAMPLE AND SEE FOR YOURSELF!

FIRST, MADISON & CLINTON STS. • **JASPER BLACKBURN PRODUCTS CORP.** • ST. LOUIS 6, MISSOURI

BUILDERS OF QUALITY PRODUCTS FOR 15 YEARS!

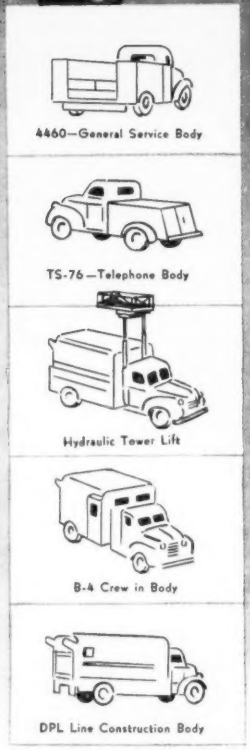
American 5805

7-MAN CREW COMPARTMENT LINE CONSTRUCTION BODY



You can paint with pride to your company name on the American 5805.

The 5805 carries everything needed on the job—notice the low derrick tunnel.



designed for extra wide hood and fender lines

• Crews like the idea of a 7-man compartment, integral with body. Good visibility, ventilation and padded seats add to crew comfort. Cab easily accessible from both sides of body. Hinged front seat permits easy entrance to rear seat. Streamlined compartment utilizes space available on the current wide models of truck chassis.

Body is exclusive American line construction design with a place for ladders, pike poles, derricks and the dozens of other items (large and small) needed on the job. Available in basic length of 138 inches.

This 7-man crew compartment body, replacing Model 3714, has been a long-time favorite with light, gas, water, telephone, municipalities and contractors.

Ask The American Coach & Body Company about Model 5805, streamlined for the extra wide hood and fender lines.

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. . . because Dieflex Tubing and Sleeving have the qualities that make assembly work easier—flexibility, smooth bore, good push-back, and non-frayability. Let your operators work with Dieflex and you will see the difference . . . see how it saves lost motion, lost time, and needless aggravation.

Engineers like Dieflex, too, because of its uniformly complete impregnation and high dielectric strength. There is a Dieflex product for every tubing and sleeving requirement—with a base of either finely braided cotton or glass fibre, impregnated with oleoresinous varnish or silicones, as your applications may require.

We would like an opportunity to show you how much Dieflex can reduce your assembly costs—will you let us?

DIEFLEX PRODUCTS LIST

MADE WITH BRAIDED COTTON SLEEVING BASE

Grade A-1 Magneto Grade Varnished Tubings
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Grades C-1 and C-2 Heavily Coated Saturated Sleevings
Grade C-3 Lightly Coated Saturated Sleevings
Heavy Wall Varnished Tubings and Saturated Sleevings

MADE WITH BRAIDED GLASS SLEEVING BASE

Grade A-1 Magneto Grade Varnished Fiberglas Tubings
Grade C-1 Extra Heavily Saturated Fiberglas Sleevings
Grade C-2 Heavily Saturated Fiberglas Sleevings
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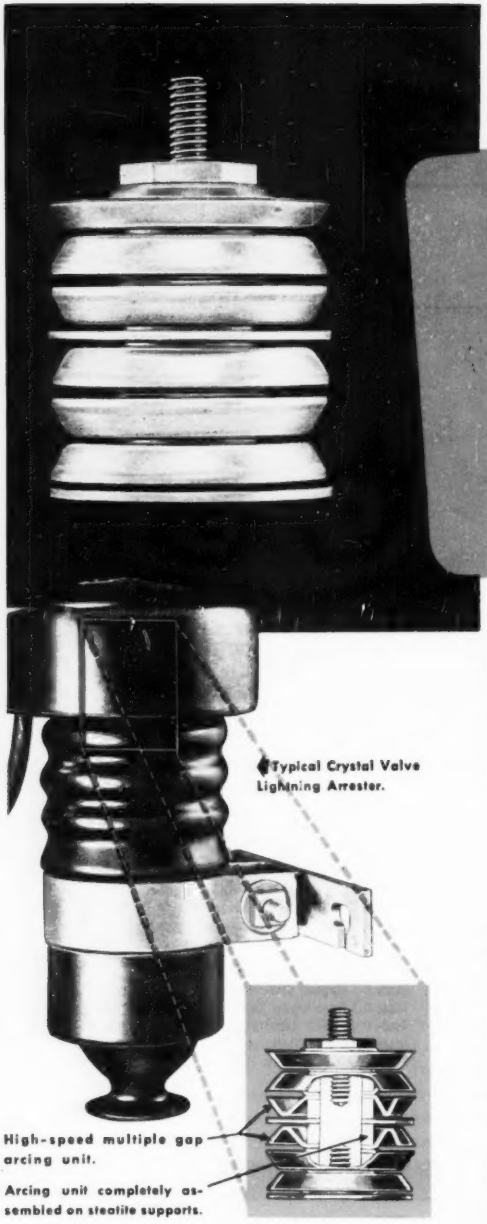

Typical Crystal Valve Lightning Arrester.

High-speed multiple gap arcing unit.

Arcing unit completely assembled on steatite supports.

LIGHTNING ARRESTERS must be FAST

SPEED of operation of a lightning arrester is a measure of the protection it will give to equipment; speed of operation is controlled largely through spark gap design and construction; hence spark gap assemblies are vitally important elements of lightning arresters.

For 30 years lightning arresters of our manufacture have embodied spark gap units of the same basic design illustrated herewith; these incorporate two fundamentally correct major features:

1—A multi-gap structure.

2—Sparkover or discharge surfaces that are smooth and flat.

Electrodes are coin-pressed to high accuracy before assembly; accurately ground steatite elements are used to space same; electrodes and spacers are assembled on a steatite rod; a costly structure—yes, but one possessing exceptionally good electrical and mechanical characteristics, highly accurate and uniform operation, short time lag and therefore high speed of operation, heavy surge current discharge capacity—*all of which cooperate with other important features of the Crystal Valve in giving highly efficient protection and long service life.*

More detailed information on the construction, operation , protective characteristics, etc. of Crystal Valve lightning arresters will be found in our current catalog. Write for a copy.

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TRANSPORTATION, POWER AND INDUSTRIAL PRODUCTS

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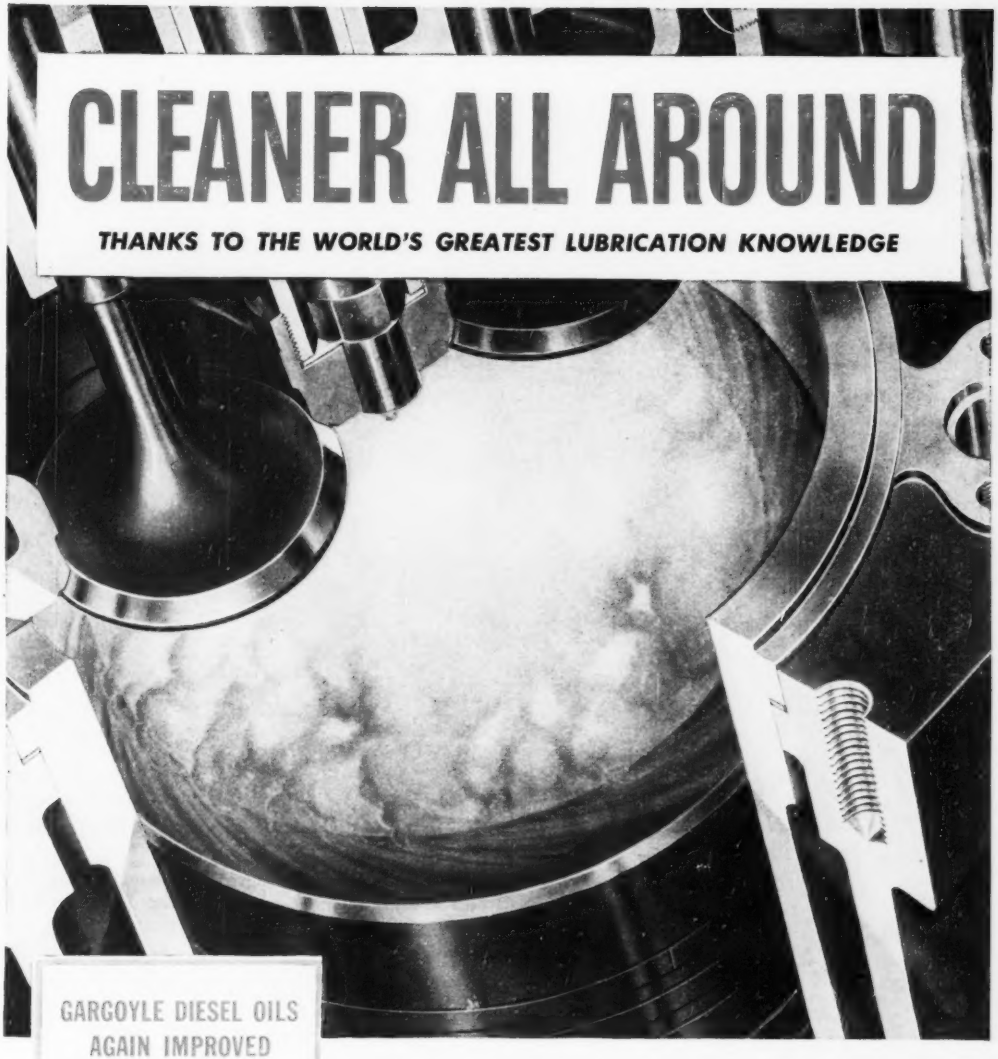
CLEANER ALL AROUND

THANKS TO THE WORLD'S GREATEST LUBRICATION KNOWLEDGE



GARGOYLE DIESEL OILS
AGAIN IMPROVED

to Minimize Deposits on Pistons, Rings, Vital Moving Parts.

★

Backed by Skilled Engineering Service.

★ ★

For CONTINUOUS POWER—Rely on the BEST!

High output Diesels, like this, call for something special in lubricating oils to combat deposits on pistons, rings, vital moving parts. So, Socony-Vacuum has come up with another important development. The newest Gargoyle Oils possess special properties that reduce oil oxidation, and also make certain that contaminating soot and sludge are dispersed...do not collect on vital parts. For details, see your Socony-Vacuum Representative.

SOCONY-VACUUM

GARGOYLE Lubricants

SOCONY-VACUUM OIL COMPANY, INC.
and Affiliates: MAGNOLIA PETROLEUM CO
GENERAL PETROLEUM CORPORATION

Rely on **SOCONY-VACUUM**
Correct Lubrication

• *The photograph and the quotation in this advertisement are used by courtesy of the Pennsylvania Sugar Company of Philadelphia, and Dan Gutleben, who until recently was Chief Electrical Engineer.*

HERE'S what the chief engineer of a large sugar refinery—using its own generators and over a thousand motors from ¼ to 150 hp—has to say about "Megger"* Insulation Testers:

> "Every Saturday . . . the Wizard (Chief Electrician) applied our 'Megger' Tester to all of our important generating equipment. Usually nothing happens . . . Then one day the 'Megger' test indicates a leak . . . Like the surgeon's X-ray the 'Megger' test detects the condition, and a failure is forestalled. With our insulation resistance records we further watch any progressive weakening of the 'arteries' and have warning that permits us to make repairs at convenient times . . . A maintenance gang without a 'Megger' tester would be like a surgeon without an X-ray machine."

Are you getting the benefit of this kind of insurance protection for the important electrical equipment in your plant? "Megger" Insulation Testers are available in various types (including the unique "Bridge-Meg" instrument here illustrated) with ratings up to 10,000 megohms and 2500 volts d-c. Write today for illustrated Bulletin 21P7-W.

*REG. U. S. PAT. OFF.

JAMES G. BIDDLE CO.
Electrical & Scientific Instruments
1316 ARCH STREET, PHILADELPHIA 7, PA.

You'll Save . . .

You'll Get Faster Deliveries with *Pennsylvania*

STANDARD PARTS POWER TRANSFORMERS

Available in the following sizes:

Three Phase: Up to 10,000 Kva, 34 Kv
Single Phase: Up to 5,000 Kva, 34 Kv

This new line of Pennsylvania Power Transformers was designed to include the desirable features of custom-built transformers, at quantity production prices. Streamlined and standardized methods of manufacture, coupled with the use of standard designs and standard parts, shorten engineering and production time. This reduces the price of the transformer and shortens the delivery time.

Standard Parts Transformers can be supplied with any method of oil preservation.

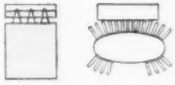
Auxiliary tanks, welded to each end of the transformer and connected to each other and to the main tank, form the following oil preservation systems:

Inert Gas-Oil Seal

Sealed Tank

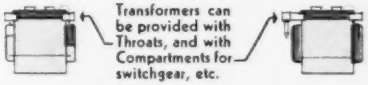
Inert Gas Pressure System

Oil expansion tank can be provided instead of auxiliary tanks.

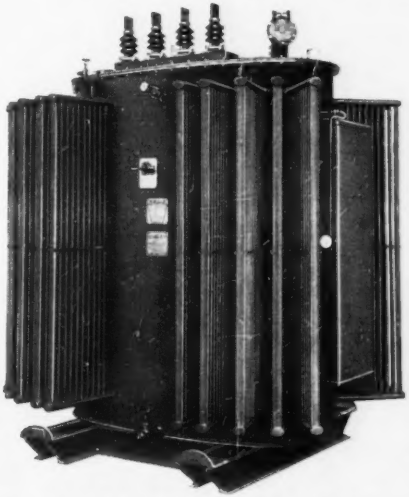


Auxiliary tanks, in most cases, do not add to the projected floor area.

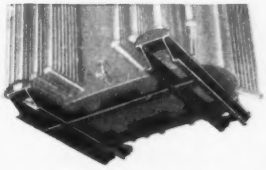
The Sealed Tank and Inert Gas Pressure Systems can be changed, in the field, to Inert Gas-Oil Seal, without difficulty and without changing any parts. Inert Gas Pressure System can also be changed to Sealed Tank.



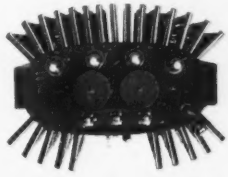
Transformers can be provided with Throats, and with Compartments for switchgear, etc.



Standard Parts Power Transformer. 3750 Kva, 3 Phase, 60 Cycles, OA, 55°C. Voltage: 12,000 Delta-4,160 Y.



Base for Standard Parts Transformer. Base is designed to simplify jacking, pulling, rolling, and painting.



Top of 4000 Kva Standard Parts Transformer. Note how auxiliary tanks fit into ends of the transformer and do not add to the length of the transformer.

Pennsylvania TRANSFORMERS

For further information, write for Booklet No. 1492

Pennsylvania
TRANSFORMER COMPANY
PITTSBURGH 12, PENNSYLVANIA

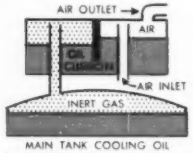
GPC

Keeps pressures down when

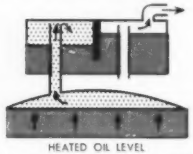
GAS PRESSURE COMPENSATED

Controls pressure

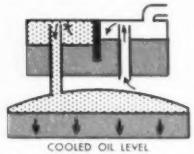
How Transformer Inert Gas Sealing System Works



Inert gas seals cooling oil from the atmosphere.



As transformer heats the transfer of gas is cushioned by change of oil levels.



As transformer cools, reverse action takes place.

TRANSFORMERS using the "Oil-Sealed" inert gas system of controlling internal pressure have been in successful operation for more than 24 years. Today, GPC Gas Pressure Compensated Cable uses a similar system to keep the internal pressure of power cables within safe limits.

Principle of Transformer Cooling System Sealed with Inert Gas

Transformer cooling oil is isolated from the atmosphere by inert gas and oil seal. As the transformer heats, the cooling oil expands, displacing inert gas from main tank to auxiliary tank. The transfer of gas is cushioned by the change in oil levels, keeping the main tank pressure low. As transformer cools the reverse takes place.

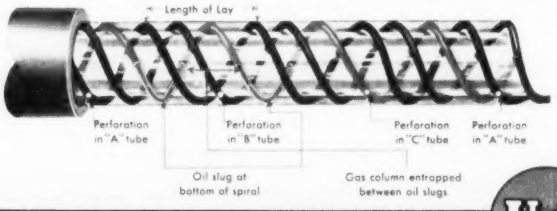
Principle of GPC Gas Pressure Compensated Cable

Like a transformer, this cable uses an inert gas, (nitrogen,) and insulating oil to keep the cable pressure within prescribed limits. The helical tubes shown in the diagram below are filled with dry nitrogen gas and are perforated at intervals. After cable installation, slugs of insulating compound collect in the low portions of the tubes while gas collects in the high portions. As the load is applied the insulating saturant (oil) expands and compresses the trapped gas which acts as a cushion to prevent development of pressures that would normally stretch the lead sheath. Upon cooling of the cable, the gas compressed in the tubes forces the oil saturant back into the cable, thus preventing wide swings from pressure to vacuum such as encountered in ordinary solid type cable.

This cable has proved highly satisfactory in use and carries heavy overloads without danger of sheath expansion. It is recommended for power plants, utilities, factories — wherever large amounts of power must be transmitted efficiently and dependably. Write for complete engineering information and installation details.

How Inert Gas Controls Pressure in GPC Gas Pressure Compensated Cable

As cable heats, gas is compressed in small tubes keeping pressure within prescribed limits.


Length of Lay
Perforation in "A" tube
Perforation in "B" tube
Perforation in "C" tube
Perforation in "A" tube
Oil slug at bottom of spiral
Gas column entrapped between oil slugs

USS

the heat is on

PAPER CABLE

.like a transformer

Power transformer with inert gas seal for controlling internal pressure without exposing cooling oil to the atmosphere.

ADVANTAGES OF GPC "GAS PRESSURE COMPENSATED" CABLE

1. Insulation maintained thoroughly saturated with compound at all times.
2. Internal pressure is stabilized within prescribed limits.
3. Controlled sheath stresses. There is no repeated expansion and contraction, no fatigue or splitting of lead.
4. Pressure along cable line is uniform, not variable from joint to center of section to joint.
5. Interchangeability. Cable can be spliced to existing solid type cable without difficulty.
6. Increased current carrying capacity. Many present-day limits are based on allowable sheath stress. Type GPC Cable controls these stresses.
7. Improvement in operating voltage stress is possible, since ionization and gas inclusions are eliminated.
8. Reduced over-all transmission cost per KVA mile.
9. Continuous sheath supervision.

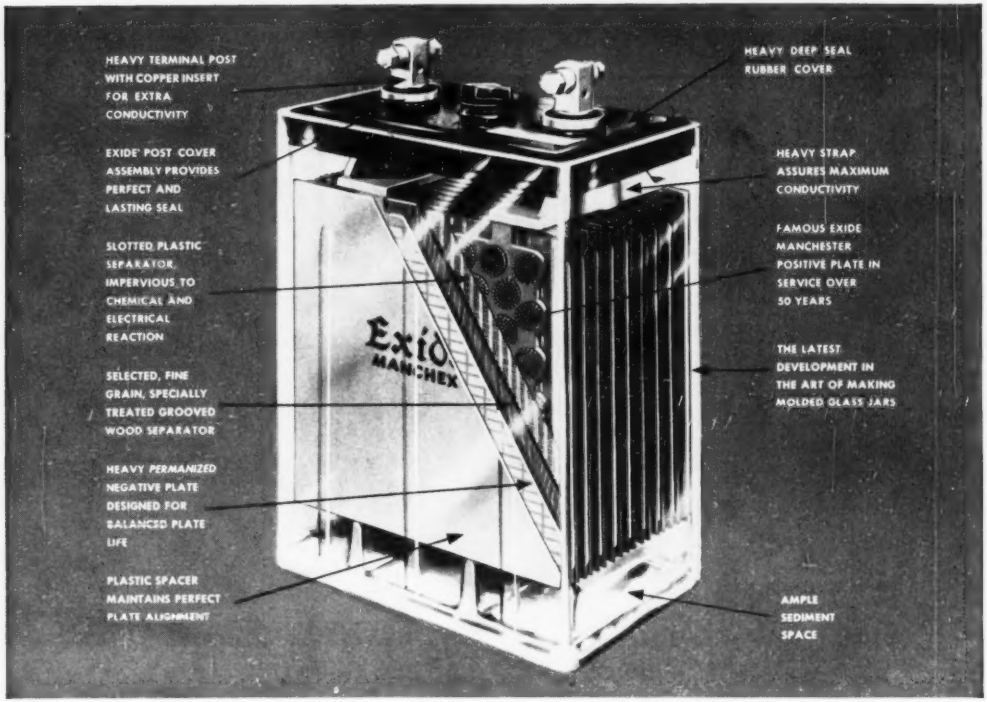
AMERICAN STEEL & WIRE COMPANY, GENERAL OFFICES: CLEVELAND, OHIO
COLUMBIA STEEL COMPANY, SAN FRANCISCO, PACIFIC COAST DISTRIBUTORS
TENNESSEE COAL, IRON & RAILROAD COMPANY, BIRMINGHAM, SOUTHERN DISTRIBUTORS
UNITED STATES STEEL EXPORT COMPANY, NEW YORK

U·S·S Paper Insulated Cables

UNITED STATES STEEL

NEW-EXIDE-MANCHEX battery

for dependable CENTRAL STATION SERVICE


HEAVY TERMINAL POST WITH COPPER INSERT FOR EXTRA CONDUCTIVITY
EXIDE POST COVER ASSEMBLY PROVIDES PERFECT AND LASTING SEAL
SLOTTED PLASTIC SEPARATOR IMPERVIOUS TO CHEMICAL AND ELECTRICAL REACTION
SELECTED, FINE GRAIN, SPECIALLY TREATED GROOVED WOOD SEPARATOR
HEAVY *PERMANIZED* NEGATIVE PLATE DESIGNED FOR BALANCED PLATE LIFE
PLASTIC SPACER MAINTAINS PERFECT PLATE ALIGNMENT
HEAVY DEEP SEAL RUBBER COVER
HEAVY STRAP ASSURES MAXIMUM CONDUCTIVITY
FAMOUS EXIDE MANCHESTER POSITIVE PLATE IN SERVICE OVER 50 YEARS
THE LATEST DEVELOPMENT IN THE ART OF MAKING MOLDED GLASS JARS
AMPLE SEDIMENT SPACE
Exide
MANCHEX

"Exide" and "Permanized" *Reg. Trade-Marks U. S. Pat. Off.*

One of its many exclusive features is the famous MANCHESTER POSITIVE PLATES with their unique lead button construction. The buttons—rolled strips of corrugated soft lead—are pressed into holes of the lead-antimony grid. Forming action expands the buttons and locks them securely in place. Only a comparatively small portion of the total lead is formed initially into active material . . . the balance is available for gradual conversion in service.

THE PERMANIZED NEGATIVE PLATES are constructed of a lead-antimony grid, or framework, with a series of vertical ribs connected by short horizontal bars. Bars are flush with plate surface . . . extend only part way through the plate . . . are staggered on opposite sides. The active material . . . sponge lead . . . is formed of vertical strips or ribbons that extend from top to bottom of the plate between the vertical ribs and is locked in place by the horizontal bars. The new EXIDE-MANCHEX BATTERY has a high, 1 minute rating. It will provide up to 100% more capacity in the same given space.

LONG LIFE...LOW MAINTENANCE COST...IMPROVED ELECTRICAL CHARACTERISTICS...INCREASED POWER (watt) OUTPUT PER UNIT OF SPACE...LESS WEIGHT PER AMPERE HOUR OUTPUT...ATTRACTIVE INSTALLATION

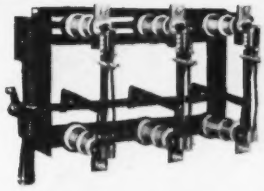
Exide
BATTERIES

1888 — Dependable Batteries for 61 Years — 1949

THE ELECTRIC STORAGE BATTERY COMPANY, Philadelphia 32 • *Exide Batteries of Canada, Limited, Toronto*

Backed by the world wide BROWN BOVERI reputation

J. B.
Suggest we look into these—
P. F.

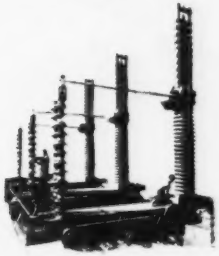


BROWN BOVERI LOAD DISCONNECTS

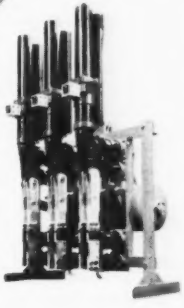
15 kV, 400 Amp load-disconnect. Requires no outside air supply. Will interrupt 150% of rated current. Simple, reliable, ideal for substations and branch lines. Available for 7.5 and 15 kV, without or with steel housing [for outdoor service], interrupting 10,000 and 15,000 kVA respectively, 500 operation guaranteed without maintenance.

BROWN BOVERI

BROWN BOVERI *HIGH SPEED* AIR BLAST BREAKERS



220 kV, 2,500,000 kVA, 3½ cycles, outdoor air-blast breaker for rapid reclosing operation (in service in Canadian, Swedish and other networks since 1942). Standard voltages 80, 110, 220 kV. Available for up to 5,000,000 kVA symmetrical interrupting capacity.



High Speed Air Blast Breaker type DB 20 n 1000 (American Standard line No. 25), 15 kV, 1200 Amps, 500,000 kVA.

Full line of indoor breakers 7.5 to 46 kV 1000 to 4000 Amps; up to 2,000,000 kV interrupting capacity.

No oil handling, no contact inspection or maintenance required after any interruption within rating—Powerful air blast action instantly removes foot points of arc from normally current carrying parts!

DO YOU HAVE THE LATEST BROWN BOVERI BULLETINS?

They illustrate and describe our complete line of electrical and mechanical equipment, examples of which are shown here. These Bulletins are really "text books" of the latest modern developments, which merit the careful consideration of Engineers responsible for continuous operation and low maintenance costs. Copies sent upon request on your business letterhead.

BROWN BOVERI CORP., 19 RECTOR ST., NEW YORK 6, N. Y.

BROWN BOVERI

Progressive Engineers—Skilled Craftsmen—for Over 50 Years

SWITCHGEAR
- Air Blast Breakers
- Oil Circuit Breakers
- Power Disconnects
- High Speed DC Breakers
- Current Transformers
- Voltage Transformers

REGULATORS
- for Voltage AC and DC
- Current
- Frequency
- Power Factor
- Paper Machines
- Turbine governing

RELAYS
- Current, Voltage, Power
- Thermal
- Differential
- Ground Fault
- Distance
- Buchholz

MOTORS AND TRANSFORMERS

All Type Motors
- constant & variable speed

All Size Transformers
- fixed ratio & load tap changing

TURBINES
- Gas Turbines
- Steam Turbines
- Marine Turbines
- Centrifugal Compressors
- Axial Blowers
- Turbo Chargers

When the Underwriters Say:

"Where heater cord is used and the temperatures on the braid within the appliance exceed 90°C., supplementary insulation is required over the braid."

Would you choose--

This

Here is a labor consuming method of hand-wrapping an electric cord with thread to provide the supplementary insulation required by Underwriters' Laboratories, Inc.

or This?

Here is an electric heater cord with "pants" of BH Non-Fraying Fiberglas Sleeving, easily slipped over the leads and covered by a larger BH Fiberglas Sleeving. Saves minutes in assembly time. Approved by Underwriters' Laboratories, Inc.

Now BH Non-Fraying Fiberglas Sleeving gives you a better, faster way of providing supplementary insulation required by the Underwriters' for built-in heater cord. Recent assembly tests have shown savings of three minutes in the insulation of a single heater cord. Slow hand-wrapping methods take time, cost more and are not uniform. With BH Non-Fraying Fiberglas Sleeving, there are no threads to break or unravel. No possibility of partially-uncovered braid. No time spent in job-training employees.

By simply slipping a section of BH Fiberglas Sleeving over each asbestos covered lead, and then fitting a larger BH Fiberglas Sleeving over the braid, the job is completed quickly and efficiently. Stays snug, yet remains flexible as string because no hardening varnish or lacquer is used in BH Fiberglas Sleeving. Will not fray, crack or split when bent. Heat resistant to 1200°F. if necessary. Can be spread to cover knobs and terminals smoothly.

Leading appliance manufacturers in every section of the country specify BH Fiberglas Sleeving for supplementary insulation in their products. BH Non-Fraying Fiberglas Sleeving is made in all standard sizes and colors, in standard 36" lengths and 500' coils, or it may be supplied in short lengths to meet specific requirements. Use it in your plant, in your product. Write today for details.

BENTLEY, HARRIS MFG. CO., CONSHOHOCKEN, PA.

BH *Fiberglas* SLEEVINGS

*BH Non-Fraying Fiberglas Sleevings are made by an exclusive Bentley, Harris process (U. S. Pat. No. 2395310). "Fiberglas" is Reg. T.M. of Owens-Corning Fiberglas Corp.

USE COUPON NOW

Bentley, Harris Mfg. Co., Dept. W-31, Conshohocken, Pa.

I am interested in BH Non-Fraying Fiberglas Sleeving _____ for (size or I.D.) _____ operating at temperatures of _____°F. at _____ volts. Send samples (product) so I can see how BH Fiberglas Sleeving stays flexible as string, will not crack when bent.

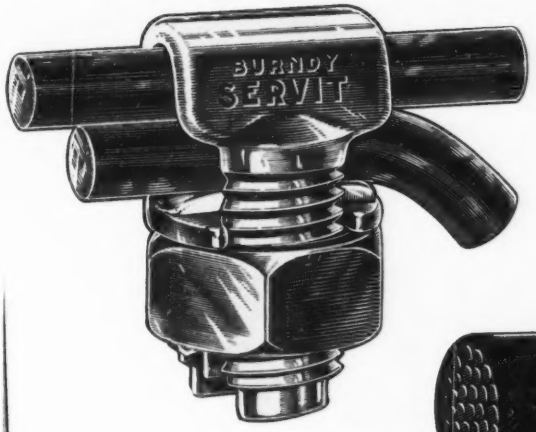
NAME _____ COMPANY _____

ADDRESS _____

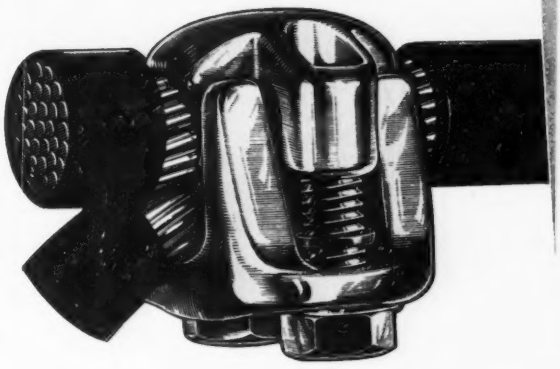
Send samples, pamphlet and prices on other BH Products as follows:

- ☐ Cotton or Rayon-base Sleeving and Tubing
- ☐ Ben-Har Special Treated Fiberglas Tubing

The *Leaders* in SERVICE CONNECTORS



Servit
—8 sizes for cables
from #10 to 4/0



Oklip
—6 sizes for cables
from 2/0 to 1000 Mcm.

BOTH APPROVED

LISTED UNDER REEXAMINATION SERVICE UNDERWRITERS' LABORATORIES, INC. UL

These two popular Burndy service connectors *lead all others* by a wide margin at the point of sale, for the following reasons:

- *all sizes indicated are UL approved*
- *rounded corners and compactness make taping easy*
- *each size accommodates a wide range of conductor sizes*
- *both have the high strength and high conductivity found in all connectors of Burndy manufacture*

A free copy of the Burndy "SERVIT SELECTOR," convenient for selecting the right service connector, is yours for the asking.

Connect with

BURNDY

New York 54, N. Y.

WESTERN BRANCH: Vernon 11, California • CANADA: Canadian Line Materials, Ltd., Toronto 13
FOREIGN: Philips Export Corp., New York 17, N. Y.

How does your cable look to Father Time?

If you asked Father Time how to get the most service from your cable investment, he'd surely point to Ansonia Ankoseal plastic insulated and jacketed cable. For he knows how long it outlasts the conventional parkway cable of rubber, lead, steel tape, and jute. It also resists the corrosive agents that always shorten the life of lead-covered cable. It remains unaffected by the sunlight and ozone which readily attack the covering of railroad cable types. Any comparison you make shows the superiority of Ansonia Ankoseal Cables.

Write for your copy of the new booklet on Ansonia Ankoseal Power Cables now, or if you have an immediate problem—phone, write, or wire us for more specific information.

THE ANSONIA ELECTRICAL COMPANY

SUBSIDIARY OF NOMA ELECTRIC CORPORATION

ANSONIA, CONNECTICUT

Cole Electric Co.

8439 Steller Drive — Culver City, Calif.

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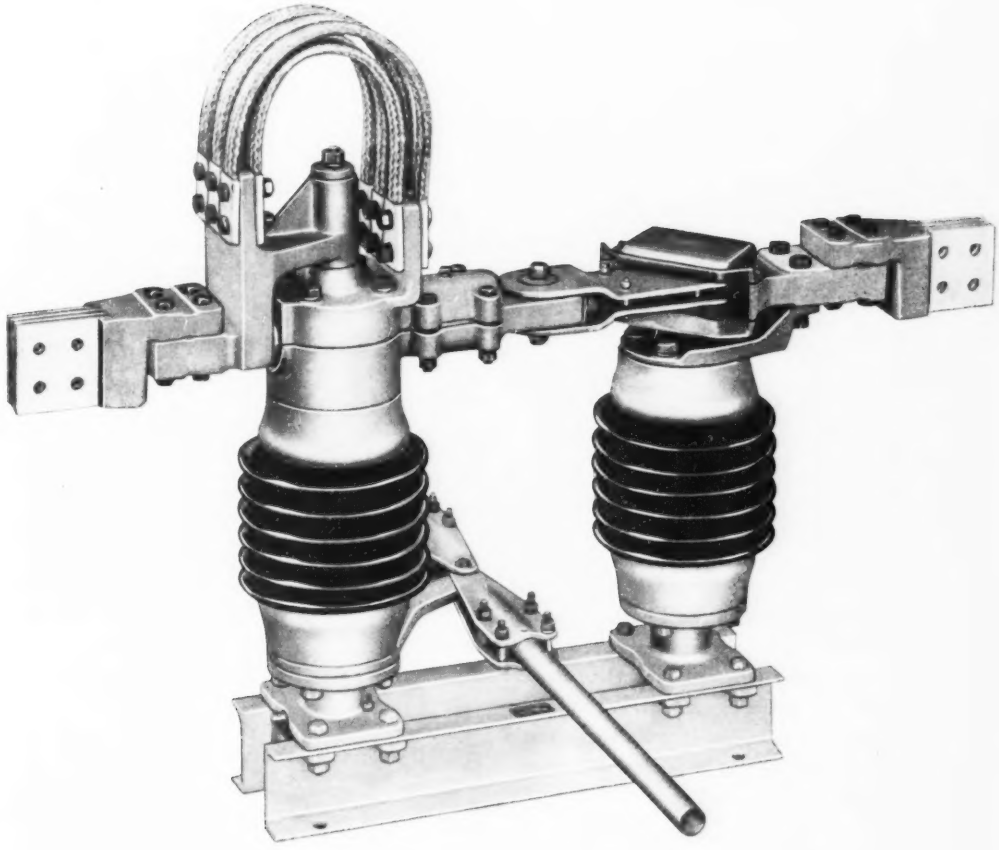
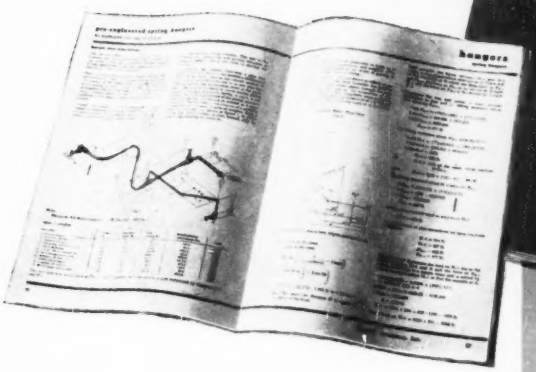


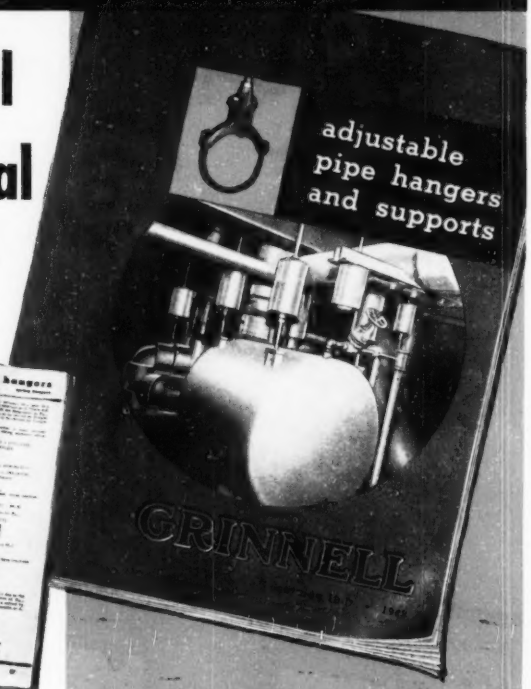
OUTDOOR DISCONNECTING SWITCH
23000 Volts—2000 Amperes
Type LU- Three Pole-Single Throw
Single Side Break—Group Operated
(One Pole Shown) Bulletin 42 A

You'd pay real money for this book!

The NEW Grinnell Pipe Hanger Manual

. . . and comprehensive catalog 10-D





FIRST TIME . . . in one 92-page book every pipe hanger, part and accessory, with full instructions for easy selection and correct specification.

Grinnell engineers worked for months to put into one orderly, completely illustrated book everything you need to write hanger specifications precisely. It's a complete catalog of Grinnell Pipe Hangers and Supports and a comprehensive manual . . . all in one. It's worth money to you but it doesn't cost you a penny. Write for your copy today. Grinnell Company, Inc., Providence 1, R. I.

- ★ **Maximum recommended load rating for each hanger at various temperatures with minimum safety factor of 5**
- ★ **How to make load calculations for spring hangers, step by step, with drawings**
- ★ **Constant support or variable spring hangers may be selected and specified from simple load tables**
- ★ **Method of calculating take-out and determining hanger rod lengths . . . schematic drawings and formulas**
- ★ **Standard specifications with tables of maximum spacing between pipe supports, load carrying capacity of steel hanger rod, also rod size as determined by pipe size for fire protection work**
- ★ **A complete line of cast and malleable hangers ranging from the simplest plumbing or heating installation to the most complicated power plant installation**

99 YEARS
WHENEVER PIPING IS INVOLVED

GRINNELL

Save Time on Every Job!

Order ALL Your Insulators and Accessories from Porcelain Products Inc.

Buy all your distribution and transmission insulators and accessories from one reliable source. Round out and complete your stocks with PORCELAIN PRODUCTS' complete line of performance-tested wet process porcelain insulators, and save time on both maintenance and new construction. Ask us to send a representative to discuss your needs. Catalog and price information sent on request.

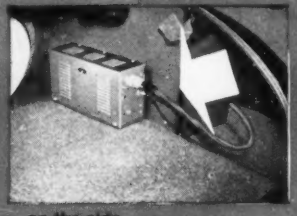
Porcelain Products, Inc.

PARKERSBURG, WEST VIRGINIA

It's Here...

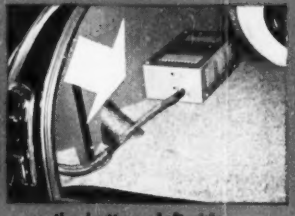
THE COMPLETE CARFONE . . . with self-contained power supply, single-unit control box and loud-speaker, and handy palm-type microphone. A super-flexible, easy-mounting antenna also is included.

LOOK HOW MANY WAYS THE CARFONE CAN BE INSTALLED



—on the side

—on the bottom, right side



—on the bottom, left side

the RCA Carfone*

152-174 Mc Mobile Communication Equipment

THIS IS IT—the newest and most revolutionary 2-way FM mobile radio in the field. It is designed to meet every communication need of the present. *And it's engineered to anticipate the requirements of the future!*

Unlike "warmed-up" versions of conventional 2-way radios, the RCA CARFONE is radically new from input to output.

• For example, the CARFONE has "31-Circuit" Selectivity. Here, 31 tuned circuits in the receiver introduce a new degree of selectivity that *makes reception on adjacent channels a practical reality* . . . enables CARFONE-equipped cars and trucks to operate over a greater geographical area *without interference.*

• For example, the CARFONE is designed with the Transducer Modulation Control . . . a new type of transmitter circuit that compensates for both loud and soft voices—*automatically.* This circuit advancement is simpler, adds no distortion, and keeps the CARFONE transmitter from interfering with adjacent channels—no matter how loud you shout into the microphone!

• For example, the All-New CARFONE combines a complete transmitter and receiver in one small compact unit (see opposite page) that provides the widest possible choice of installation locations in car or truck (see proof below).

For complete information *immediately* on the RCA CARFONE mail the coupon today.

Completely open, accessible construction puts every component and every connection "on top." In addition, the unit can be removed for service in thirty seconds.

*The RCA CARFONE is designed for every mobile radio application: police, fire departments, taxis, trucks, public utilities, buses, forestry, ambulances, pipe line services.

COMMUNICATION SECTION

RADIO CORPORATION of AMERICA

ENGINEERING PRODUCTS DEPARTMENT, CAMDEN, N.J.

In Canada: RCA VICTOR Company Limited, Montreal

Check these revolutionary All-New Features

- **NEW . . . Installation flexibility**
- **NEW . . . "31-Circuit" Selectivity**
- **NEW . . . Grounded-Grid Input for Higher Sensitivity**
- **NEW . . . Low Spurious Response in the receiver**
- **NEW . . . Low Spurious Emission from the Transmitter**
- **NEW . . . Small Size**
- **NEW . . . Extended Frequency Range**

Clip and mail today!

Department 31-B
RCA Engineering Products
Camden, New Jersey

Gentlemen:
I want all the facts on the All-New RCA CARFONE.

Name_____

Address_____

Station_____ Title_____

City_____ State_____

Jenkins Bros. also make Diamond Seal Friction and Rubber Tapes which meet ASTM and Federal Specifications.

IF YOU WANT a tape with a grip you can trust—try Gold Seal. Hot or cold . . . rain or shine . . . it sticks to the job—speeds the work. In every electrical field, it's the favorite.

Laboratory controlled production assures the lasting "tack" in the friction compound. And Gold Seal will not dry out, peel, or smear the hands. Its top quality base cloth tears evenly, quickly, without raveling.

Next time try Gold Seal . . . it's the best buy! Conveniently packed in single rolls or handy 10-roll containers . . . each roll cellophane wrapped to reach you factory fresh. Jenkins Bros., (Rubber Div.), 80 White St., New York 13, N. Y.

JENKINS *Gold Seal Tapes*

FRICTION and RUBBER TAPES

MADE BY JENKINS BROS. . . . MAKERS OF FAMOUS JENKINS VALVES

Save Money and Worry on **FAULT PROTECTION EQUIPMENT**

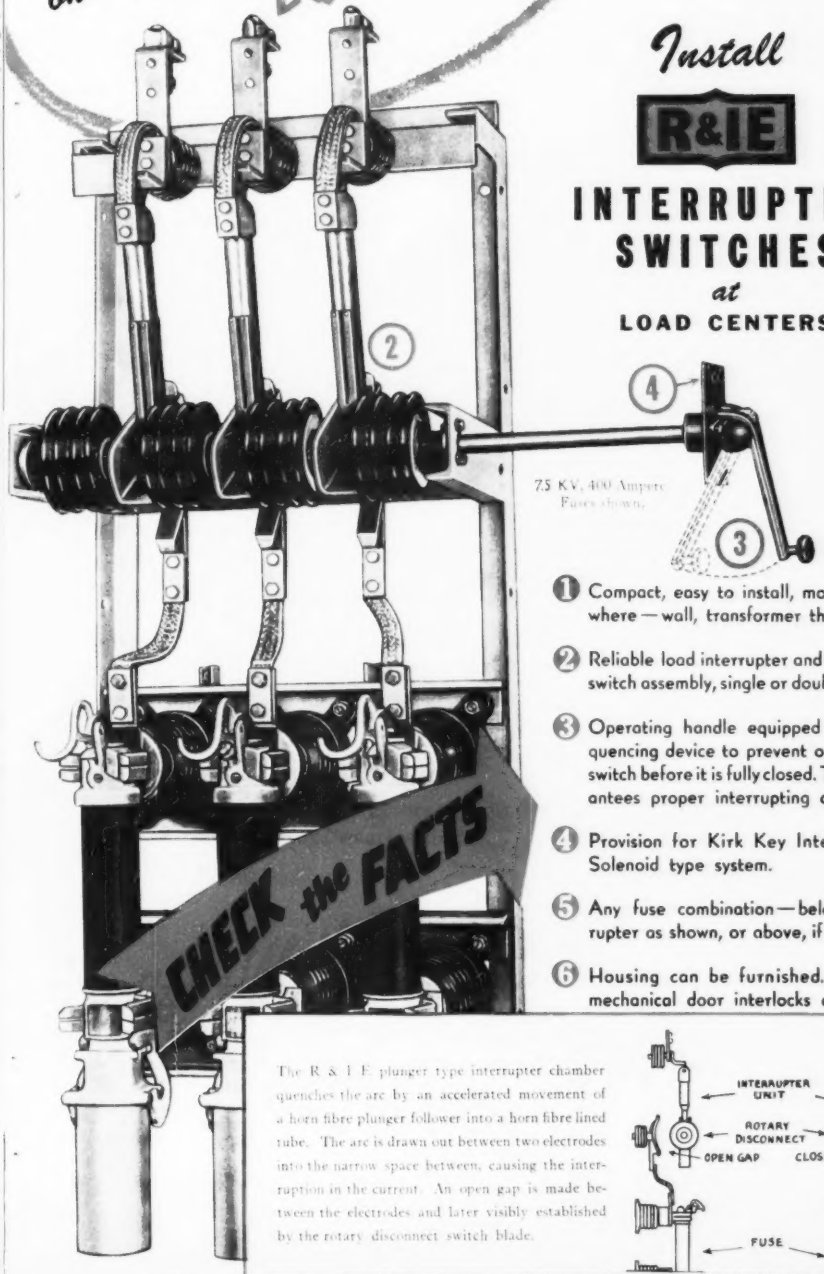
Install

R&IE

INTERRUPTER SWITCHES

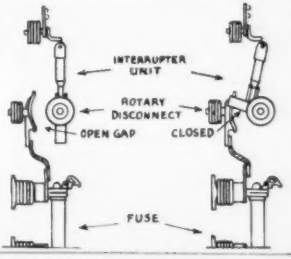
at

LOAD CENTERS



1. Compact, easy to install, mounts anywhere — wall, transformer throat, etc.
2. Reliable load interrupter and open gap switch assembly, single or double throw.
3. Operating handle equipped with sequencing device to prevent opening of switch before it is fully closed. This guarantees proper interrupting operation.
4. Provision for Kirk Key Interlock or Solenoid type system.
5. Any fuse combination — below interrupter as shown, or above, if required.
6. Housing can be furnished. Key or mechanical door interlocks optional.

The R & I E plunger type interrupter chamber quenches the arc by an accelerated movement of a horn fibre plunger follower into a horn fibre lined tube. The arc is drawn out between two electrodes into the narrow space between, causing the interruption in the current. An open gap is made between the electrodes and later visibly established by the rotary disconnect switch blade.



RAILWAY and INDUSTRIAL ENGINEERING CO., GREENSBURG, PA.

AFFILIATED WITH THE I-T-E CIRCUIT BREAKER CO., PHILADELPHIA, PA.
IN CANADA — EASTERN POWER DEVICES LIMITED, TORONTO

R&IE

The Check List

CONDUCTOR SUPPORTS, CLAMPS AND FITTINGS

DISCONNECTING SWITCHES INDOOR AND OUTDOOR

HORN GAP SWITCHES

INTERRUPTER SWITCHES

CUTOUTS AND THERMO-RUPTERS

DISTRIBUTION EQUIPMENT

SWITCH OPERATING MECHANISMS

SUBSTATIONS

OPEN OR ENCLOSED, ISOLATED PHASE HEAVY DUTY BUSES

KIRK INTERLOCK SYSTEMS

AUTOMATIC SWITCHING EQUIPMENT

METAL CUBICLES

TESTING DEVICES

"We Had Approximately 300 Motors 'Single Phase' At One Time—But Didn't Lose a Single One" . . . .

"About three months ago a primary fuse on the pole blew and threw our entire plant on single phase. At the time our plant was running full force, which meant there were approximately 300 motors running.

"Most of the motors were protected with relays or thermals, backed up by Fusetron fuses. The rest were protected by Fusetron fuses alone.

"As quickly as we realized the single phase condition existed, the main switch was pulled.

"By that time many Fusetron fuses had blown — but we didn't lose a single motor.

"Fusetron fuses more than paid for themselves that day even though we had but a short time previously gone to the expense of making a complete installation throughout the entire plant."

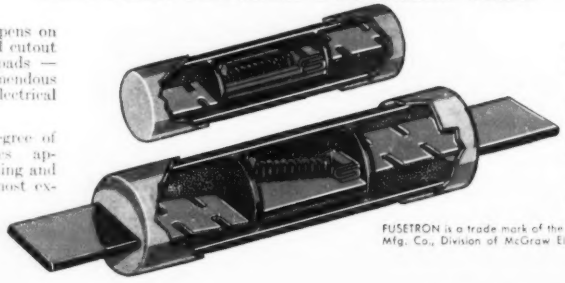
. . . Chief Electrician,
Twin Coach Co., Kent, Ohio

. . . "Thanks to . . . .

Facts About FUSETRON Dual-Element FUSES

The fuse link element opens on short-circuit — the thermal cutout element protects on overloads — the result, a fuse with tremendous time-lag and much less electrical resistance.

They have the same degree of Underwriters' Laboratories approval for both motor-running and circuit protection as the most expensive devices made.



Made to the same dimensions as ordinary fuses — fit all standard fuse holders.

Obtainable in all sizes from 1/10 to 600 ampere, both 250 and 600 volt types. Also in plug types for 125 volt circuits.

Their cost is surprisingly low.

FUSETRON is a trade mark of the Bussmann Mfg. Co., Division of McGraw Electric Co.

Fusetron DUAL-ELEMENT Fuses

with their

10 Point Protection

1. Protect against short-circuits.
2. Protect against needless blows caused by harmless overloads.
3. Protect against needless blows caused by excessive heating — lesser resistance results in cooler operation.
4. Provide thermal protection — for panels and switches against damage from heating due to poor contact.
5. Protect motors against burnout from overloading.
6. Protect motors against burnout due to single phasing.
7. Give DOUBLE burnout protection to large motors — without extra cost.
8. Make protection of small motors simple and inexpensive.
9. Protect against waste of space and money — permit use of proper size switches and panels.
10. Protect coils, transformers and solenoids against burnout.

Get All the Facts — Send the Coupon Now!

FUSETRON
TRUSTWORTHY NAMES IN ELECTRICAL PROTECTION
BUSS

FUSETRON Dual-Element Fuses Give ALL-PURPOSE PROTECTION

One needless shutdown — or one lost motor — or one destroyed switch or panel — may cost you far more than replacing every ordinary fuse with a FUSETRON dual-element fuse.

Don't risk such losses — protect yourself by installing a FUSETRON dual-element fuse in every set of fuse clips throughout the entire electrical system.

Bussmann Mfg. Co., University at Jefferson
St. Louis 7, Mo. (Division McGraw Electric Co.)

Please send me complete facts about Fusetron Dual-Element Fuses.

Name _____

Title _____

Company _____

Address _____

City _____ *State* _____

Nicopress®

The Tool and the Sleeve

that are made to work together

together
they make the perfect splice

The National Telephone Supply Company

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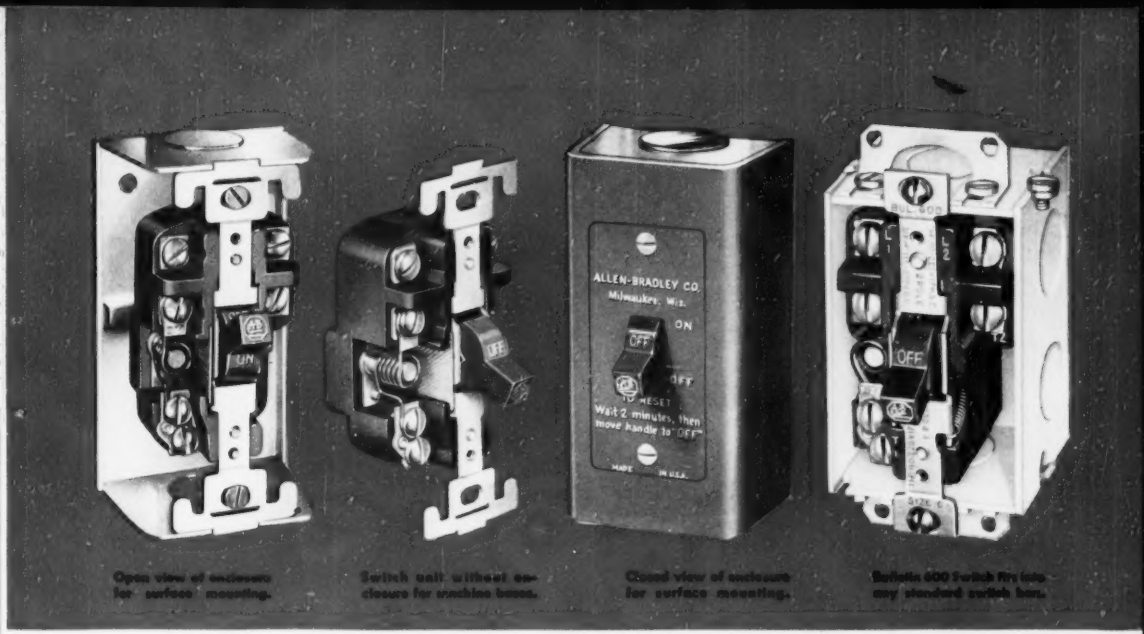
Canadian Mfr.—N. SLATER CO., LTD., HAMILTON, ONT., CANADA

Export Distributor—INTERNATIONAL STANDARD ELECTRIC CORP., NEW YORK, N. Y.

Nicopress is the Registered Trade Mark of The National Telephone Supply Company



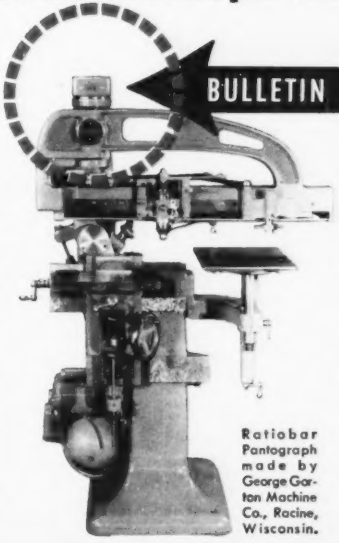
Open view of enclosure for surface mounting.

Switch unit without enclosure for machine bases.

Closed view of enclosure for surface mounting.

Bulletin 600 Switch fits into any standard switch box.

Starting Switches with Overload Protection for Fractional Horsepower Motors



BULLETIN 600 STARTING SWITCH

Ratiobar Pantograph made by George Gorton Machine Co., Racine, Wisconsin.

To satisfy the latest ruling of the National Electrical Code... which requires overload protection for many fractional horsepower motor applications... the Bulletin 600 Starting Switch is the popular answer.

Its self-contained thermal breaker is always dependable. Long periods of inactivity will not affect its accuracy. At the first sustained overload... the switch trips... and the motor is protected against burnout.

Waterproof Enclosure.

The Bulletin 600 Starting Switch cannot be held closed until the overload condition is corrected. This compact control unit is a sales asset to any machine.

Above is shown how easily the Bulletin 600 Fractional Horsepower Starting Switch fits into the standard Allen-Bradley enclosure or into any standard switch box.

The switch unit can also be mounted in any suitable cavity in the machine frame.

For locations requiring enclosures to operate in wet or hazardous locations, there are several standard A-B enclosures to meet every service requirement.

Bulletin 600 Switches are available with pilot lights, selector switches, and other accessories. Send for complete data, today.

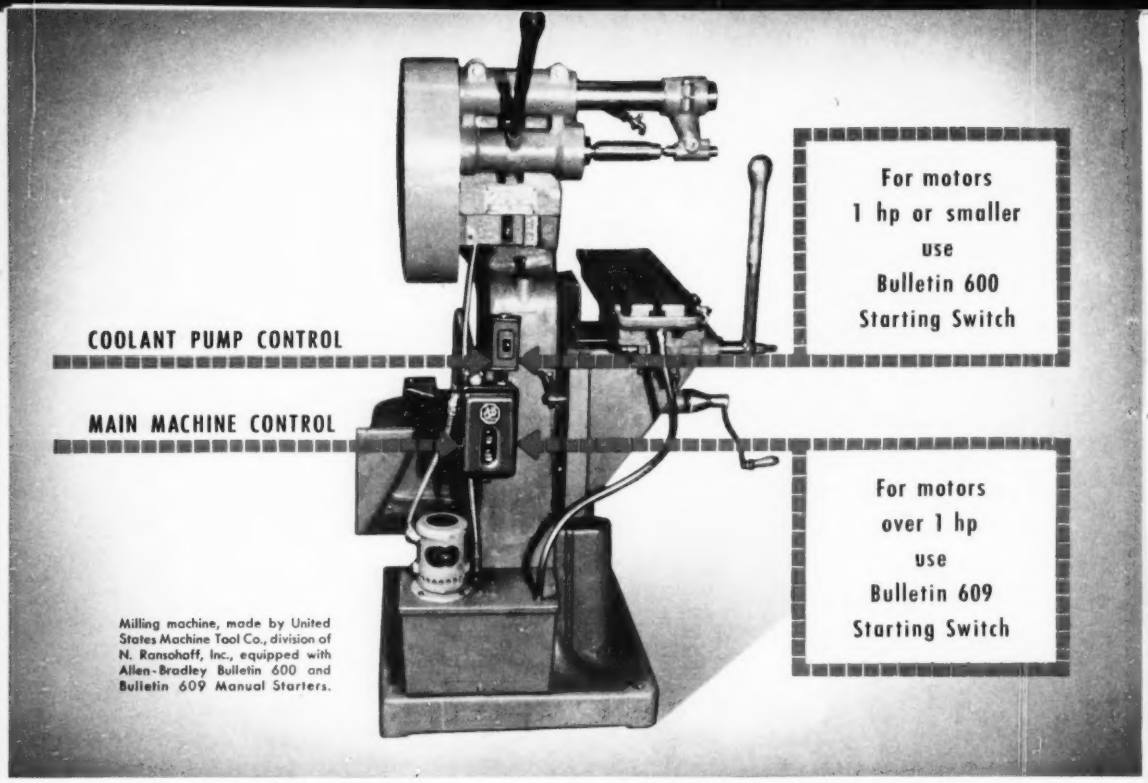
ALLEN-BRADLEY

QUALITY

BULLETIN 600 STARTING SWITCHES

A-B Quality

Allen-Bradley Co.
1316 S. Second Street
Milwaukee 4, Wis.



Milling machine, made by United States Machine Tool Co., division of N. Ransohoff, Inc., equipped with Allen-Bradley Bulletin 600 and Bulletin 609 Manual Starters.

How to Pick the Right Manual Starter

For Motors of 1 hp or less—Specify the compact Allen-Bradley Bulletin 600 Manual Starting Switch. It is so small that it fits easily into any standard conduit switch box . . . with ample wiring space.

A self-contained thermal overload breaker trips the switch when the motor is overloaded. The switch cannot be reclosed until the overload condition is corrected. A full line of enclosures is available for every service application.

Bulletin 609 Starter in steel enclosure. Note white interior and the ample wiring space.

For Motors of 1-5 hp, 220 v—1-7½ hp, 600 v Specify the popular Allen-Bradley Bulletin 609 Manual Starter, available in enclosures for general, waterproof, dust-tight, and hazardous locations.

Quick-make and quick-break silver alloy contacts . . . double overload breakers . . . and handy push-button operation are a few of the assets of this popular manual starter. Available also for mounting in machine bases.

Send for Third Edition of Allen-Bradley Condensed Catalog . . . . just off the press.

Allen-Bradley Co.
1316 S. Second St., Milwaukee 4, Wis.

ALLEN-BRADLEY
MANUAL AND AUTOMATIC MOTOR CONTROLS
QUALITY

A-B Quality

WHY ARE YOU IN THE ELECTRICAL BUSINESS?

THE *real* reason you're in the electrical business is to make money . . . isn't it?

Well, do *you* know any better way to *make* money than to *save* money?

You can save *plenty* of money with trucks that fit your job . . . Dodge "*Job-Rated*" trucks.

It stands to reason that you waste money with a truck that's too big for its job; and you're in for plenty of costly maintenance expense if your trucks are too small.

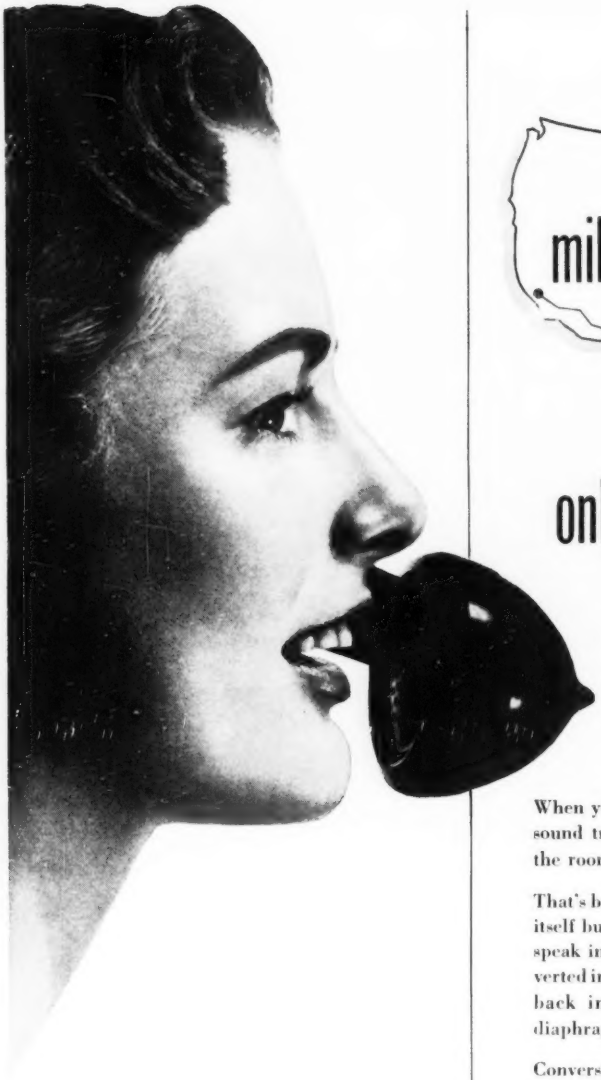
From 248 basic chassis models, your Dodge dealer can specify a truck that will be "*Job-Rated*" exactly for your hauling job.

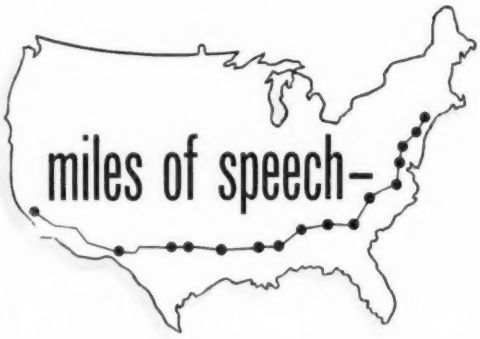
Such a truck will have the right one of seven great truck engines . . . for top efficiency and maximum economy. It will have the right units throughout . . . to haul *your* loads, over *your* roads.

And remember . . . only Dodge builds "*Job-Rated*" trucks. Talk to your Dodge dealer!

For the good of your business—

Switch to DODGE "Job-Rated" TRUCKS





only inches of sound!

When you talk by telephone, far or near, the actual sound travels much less than when you talk across the room!

That's because the telephone system carries not sound itself but an electrical facsimile of sound. When you speak into a telephone transmitter your voice is converted into electrical vibrations which are not changed back into sound until they reach the receiver diaphragm.

Conversion of sound into its electrical equivalent, through the invention of the telephone, opened the way to the measurement of sound by accurate electrical methods. In developing means to make the telephone talk farther and sound clearer, the scientists of Bell Telephone Laboratories had to develop the tools for sound-wave analysis and measurement.

The condenser microphone, the wave filter, the amplifier — each the product of telephone research — have helped to reveal the structure of sound as never before. Each has helped to build the world's finest telephone system.

BELL TELEPHONE LABORATORIES

EXPLORING AND INVENTING, DEVISING AND PERFECTING, FOR CONTINUED IMPROVEMENTS AND ECONOMIES IN TELEPHONE SERVICE.

2000-AMPERE DISCONNECTS

Open them with Ease and Slam them Closed

PACIFIC ELECTRIC
builds them TOUGH for
Long Trouble-Free Service

Tested at 80,000 Amps. for 5 Seconds

Ice covered or in desert heat, these rugged outdoor disconnects can be relied upon for easy operation and to carry the rated load continuously because—

1. Nonferrous parts above insulator caps, including bolts, nuts and washers, prevent corrosion.

2. Two double blades are of hard-drawn high-conductivity copper. Metals of different hardness prevent galling.

3. Rugged blade stops are built in.

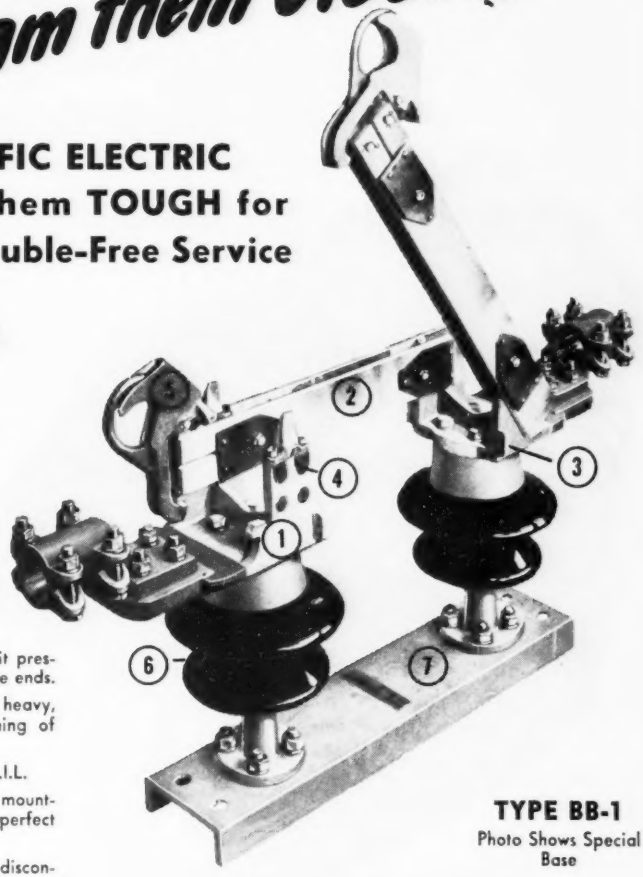
4. Contacts of long wipe have high-unit pressures and are silvered on tongue and hinge ends.

5. Safety latches of pry-off type are heavy, positive and easy operating. Easy opening of switch under thick ice is assured.

6. Insulators are N.E.M.A. Standard B.I.L.

7. Bases of formed heavy steel, with flat mounting surfaces, assure easy installation and perfect alignment.

Ask for full details about these outdoor disconnects of rugged construction for long years of trouble-free service.



TYPE BB-1
Photo Shows Special Base

2000 amps., 7½ kv. to 34½ kv.

Call PACIFIC ELECTRIC MFG. CORPORATION
5815 THIRD STREET, SAN FRANCISCO 24, CALIFORNIA • P.O. BOX 419, GARY, INDIANA

PIERCE G. FREDERICKS, 90 West St., New York 6, N. Y.
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HAWORTH L. BRUECK CO., 53 W. Jackson Blvd., Chicago 4, Ill.

Representatives in Principal Cities

NEVER BEFORE!

A G-E General-Purpose* Insulating Varnish

WITH THESE OUTSTANDING CHARACTERISTICS

G.E.'s new 9574

☑ EXCELLENT BONDING STRENGTH

General-purpose 9574 has excellent bonding properties. It is ideal for all types of motor windings (except extra high-speed armatures), and has outstanding electrical characteristics.

☑ EASIER TO WORK

G-E 9574 is a phenolic drying-oil varnish. It's particularly easy to use and handle. It has an unusually high flash point (100 F), and its viscosity (250 C. P. average at 45 F) makes it usable at barrel gravity.

☑ NO SPECIAL THINNERS REQUIRED

G-E 9574 can be thinned with ordinary petroleum spirits up to 20%.

☑ CURES AT LOW TEMPERATURES

This clear-baking varnish cures at low temperatures. A baking cycle as low as 212 F is successful in conventional baking equipment.

☑ PENETRATES DEEPEST COILS

G-E 9574 easily penetrates the deepest coils, forms an even film. Aging properties are excellent.

**G-E 9574 gives excellent results on all types of coils except extra high-speed armatures.*

MAKE YOUR MOTOR REPAIRS EASIER, MORE EFFICIENT BY USING G-E 9574!

Get more information on this remarkable general-purpose insulating varnish. New bulletin gives you full details. Just write to your local G-E Distributor or Chemical Department, General Electric Company, Pittsfield, Mass.

You Can Put Your Confidence in

GENERAL ELECTRIC

Why Gulfcrest Oil WCR

lasts indefinitely — keeps turbine systems clean

Gulfcrest is the only turbine oil that's Alchlor-processed. This is an extra refining step. It makes Gulfcrest extra pure and extra efficient. In Cylinder 1 you see the oil that will become Gulfcrest. It has gone through the usual steps used in refining most other turbine oils—but has not yet been Alchlor-processed.

In Cylinder 2 you see the part—approximately 15%—discarded by the Alchlor Process. This is the part that, when allowed to remain in turbine oil, is most likely to oxidize, increase neutralization number, and form sludge, emulsifiers, and acids.

In Cylinder 3 you see the finished Gulfcrest—the incomparably pure lubricating oil that gives outstanding performance and helps you keep steam turbine systems clean indefinitely. To make it even finer, special inhibitors are added to it—they give it still greater stability and protect against corrosion.

Call in a Gulf Lubrication Engineer today and ask him to recommend the proper grade of Gulfcrest Oil to meet the specific requirements of your turbines. Write, wire, or phone your nearest Gulf office.

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Please send me, without obligation, a copy of your booklet "Gulfcrest Oil for Steam Turbine Lubrication."

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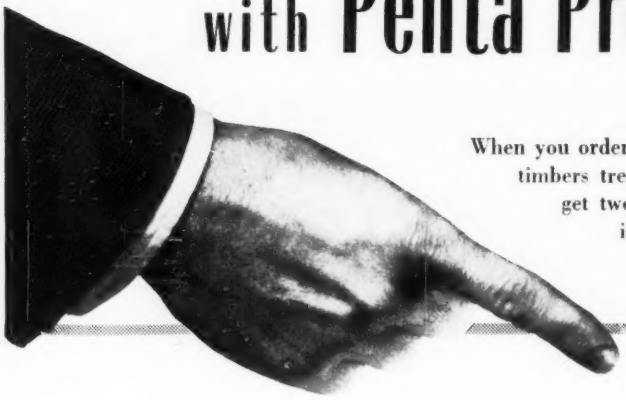
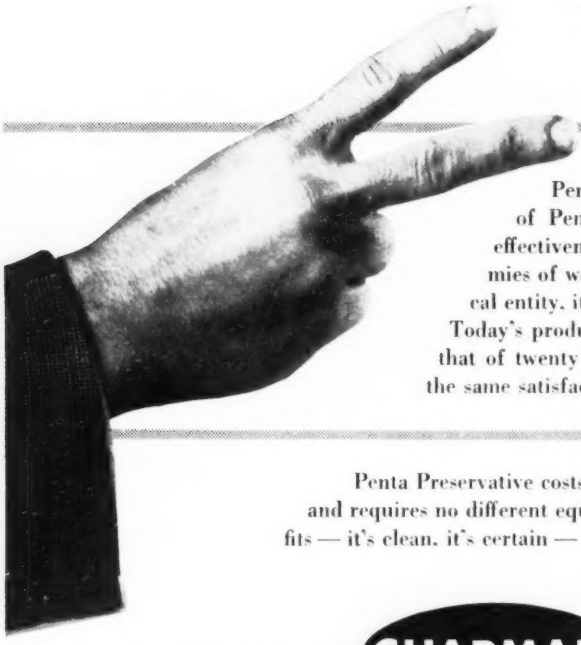
TWO Advantages with Penta Preservative



When you order your poles, cross arms and other timbers treated with Penta Preservative you get two qualities that should be of first importance to you.

It's Clean

Wood treated with Penta Preservative is not unpleasant to handle or work with. It doesn't soil hands or clothes. It has no appreciable odor.



It's Certain

Pentachlorophenol, the active ingredient of Penta Preservative, has demonstrated its effectiveness against rot, termites, and other enemies of wood. And because it is a definite chemical entity, it remains unchanged through the years. Today's production has identical characteristics with that of twenty years ago. You can be sure of getting the same satisfactory results shown by old applications.

Penta Preservative costs no more than other treating materials, and requires no different equipment or techniques. The extra benefits — it's clean, it's certain — involve neither expense nor trouble.

CLEAN • IT'S CERTAIN • IT'S CLEAN • IT'S CERTA **CHAPMAN** IT'S CLEAN • IT'S CERTAIN • IT'S CLEAN • IT'S

CHAPMAN CHEMICAL COMPANY ★ **757 Dermon Building, Memphis 3, Tennessee**

YOU CAN BE **SURE**..IF IT'S Westinghouse.

A 66⅔% INCREASE IN CAPACITY
...AN 11% REDUCTION IN WEIGHT PER KVAR
...AT THE SAME PRICE PER KVAR

IT'S THE NEW WESTINGHOUSE

25 kvar Inerteen Capacitor

Identical mounting dimensions and only slightly greater physical size are illustrated in this comparison view of the new 25-kvar capacitor with 15-kvar units of the same voltage ratings. (Left, 7,200 volts; right, 2,400 volts.)

Here's something you've been waiting for . . . the new Westinghouse 25-kvar, distribution-type capacitor. Here is extra capacity for power-factor correction . . . for limiting line current to that producing revenue. In addition, you get the same features that contribute to the superiority of the 15-kvar design.

The new capacitor, while slightly larger than the 15-kvar unit, is actually 11% lighter per kvar and can be used interchangeably with 15-kvar units in the new standard one, two and four-unit hangers. Identical dimensions, from mounting lug to line terminals on both ratings, facilitate interconnections when mounted in same hangers.

The new unit is furnished for pole or structural mounting and will permit installations of greater capacity with lower cost per kvar for hangers, protective equipment and labor. To match other outdoor equipment, the new 25-kvar unit has a dark gray finish over the zinc-spray protective coating.

For more information, ask for D.B. 49-165. Call your nearest Westinghouse office or write to Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Pa.

J-60665

...with these time proved features!

- ★ **Inertex Insulating Paper**
- ★ **Inerteen Impregnation**
- ★ **Solder-Sealed Porcelain Bushings**
- ★ **Durable All-Welded Steel Cases**
- ★ **Weatherproof Zinc-Spray Finish**

Westinghouse

PLANTS IN 25 CITIES . . . OFFICES EVERYWHERE

INERTEEN CAPACITORS

LOOK BETTER...
PERFORM BETTER...

LAPP STATION POSTS

... AT VOLTAGES UP TO 161 Kv.

There's more than up-to-the-minute business—like good looks to a station on Lapp Station Posts. There is in its modern, functional appearance the promise of better performance, longer life, fewer outages, less maintenance. That's a promise backed-up by a 17-year operating record—the cold facts-and-figures of Lapp Line Posts and Station Posts in service on hundreds of systems. For extra operating security in *all* high-voltage structures specify Lapp Station Posts.

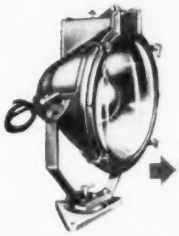
Lapp STATION POSTS

LAPP INSULATOR CO., INC. • LE ROY, N.Y., U. S. A.

CROUSE-HINDS complete line of *High-Efficiency* FLOODLIGHTS

fill a wide variety of industrial needs

They can help solve YOUR lighting problems



Type LCE-1120 Heavy Duty Floodlight

This powerful 1500-watt floodlight greatly reduces the installation cost, lighting load and maintenance cost where large areas are to be lighted. The cast aluminum alloy housing is corrosion-resisting, and weatherproof. The 20-inch polished *Alzak reflector can be furnished for either a narrow or wide beam. The narrow beam is ideal for very long range projection. Five types of lenses can be furnished. Horizontal and vertical stops facilitate relamping.

Type ADE-16 Heavy Duty Floodlight

This sturdy cast aluminum alloy, 1000-watt floodlight will give you all the advantages of type LCE-1120 but in a smaller size — with a 16-inch polished Alzak reflector. Frequently it will cost much less to project light a considerable distance with Crouse-Hinds long range floodlights than to run cable and install local lighting. There are also indoor locations in large buildings where floodlights are the most economical and satisfactory source of light.

Type MUA Alumalux Floodlight

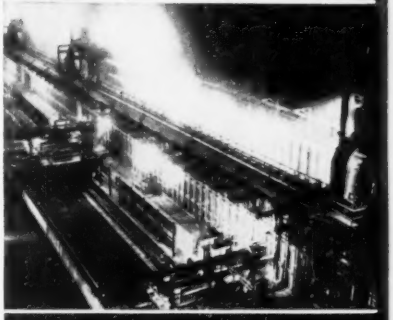
Industrial yards and auto parking lots are most efficiently lighted by the use of floodlights. Crouse-Hinds Type MUA Alumalux 1500-Watt Floodlight provides efficient lighting at mininum first cost. It is widely used for general floodlighting and is ideal for the lighting of athletic fields and playgrounds.

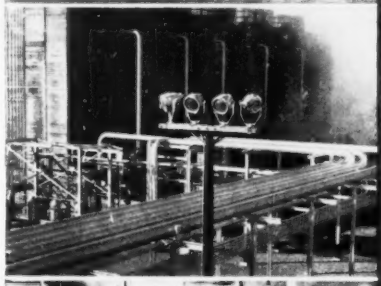
Type RLEE Explosion-Proof Floodlight

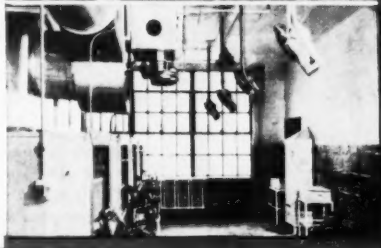
This heavy duty explosion-proof and weatherproof 500-watt floodlight has a cast aluminum alloy housing. It is designed for service in locations that are hazardous because of the presence of explosive atmospheres containing gasoline, naptha, petroleum, benzol, alcohols, acetone, lacquer solvent vapors, and natural gas. It can be furnished with either a wide or narrow beam 13-inch Alzak aluminum reflector.

Type RCDE-8 Explosion-Proof Floodlight

This is an explosion-proof floodlight in a 200-watt size, with an 8-inch reflector, either wide or narrow beam. It can be furnished for suspension mounting, standard base mounting, or as a portable floodlight with a handle and wheel base.







*Alzak is the registered trade mark of the Aluminum Company of America

A Nationwide Distribution Through Electrical Wholesalers

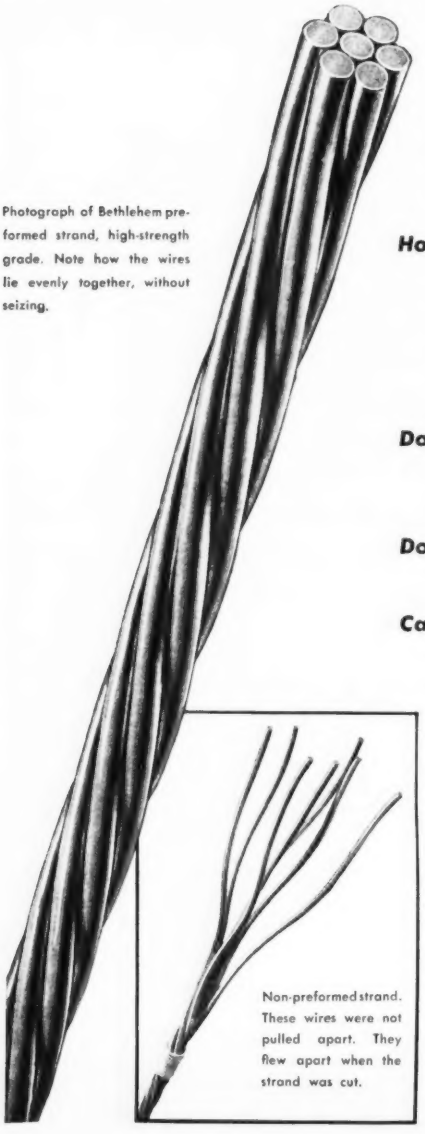
CROUSE-HINDS COMPANY
Syracuse 1, N. Y.

Offices: Birmingham – Boston – Buffalo – Chicago – Cincinnati – Cleveland – Dallas – Denver – Detroit Houston – Indianapolis – Kansas City – Los Angeles – Milwaukee – Minneapolis – New York Philadelphia – Pittsburgh – Portland, Ore. – San Francisco – Seattle – St. Louis – Washington. *Resident Representatives:* Albany – Atlanta – Charlotte – New Orleans – Richmond, Va. CROUSE-HINDS COMPANY OF CANADA, LTD., *Main Office and Plant:* TORONTO, ONT.

FLOODLIGHTS • AIRPORT LIGHTING • TRAFFIC SIGNALS • CONDULETS

Form-Set Strand

is Bethlehem's *Preformed* Strand



Photograph of Bethlehem preformed strand, high-strength grade. Note how the wires lie evenly together, without seizing.

Non-preformed strand. These wires were not pulled apart. They flew apart when the strand was cut.

Form-Set. A trade name that means just what you'd think. In Bethlehem's Form-Set strand, the "form" of each individual wire has been "set" in advance. In other words, preformed.

How Does It Differ from Ordinary Strand? Since each wire is preshaped to a permanent helix, before being laid together with its neighbors, there is no inner "spring" or tension; the wires cannot fly apart when the strand is cut. Time is saved in the field, and the strand is easier to handle —easier to insert in fittings.

Does It Cost Much Extra? NO! So little more that the extra cost is almost nothing. Most prospective buyers are very surprised—agreeably, we might add.

Does It Come in All Standard Grades and Sizes? Yes —just like conventional, non-preformed strand.

Can It Be Obtained with a Bethanized Coating? Yes indeed—with the ductile zinc armor that guards against corrosion. Form-Set strand is furnished with A-weight, B-weight, or C-weight coating, whichever best meets your requirements.

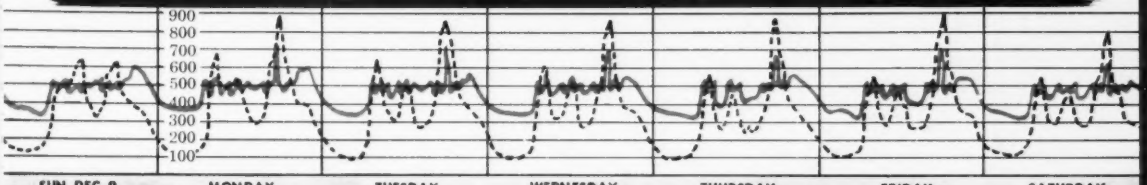
Let us tell you more about Form-Set; bring you a sample. Its advantages are best appreciated when you see and handle it yourself.

BETHLEHEM STEEL COMPANY, BETHLEHEM, PA.

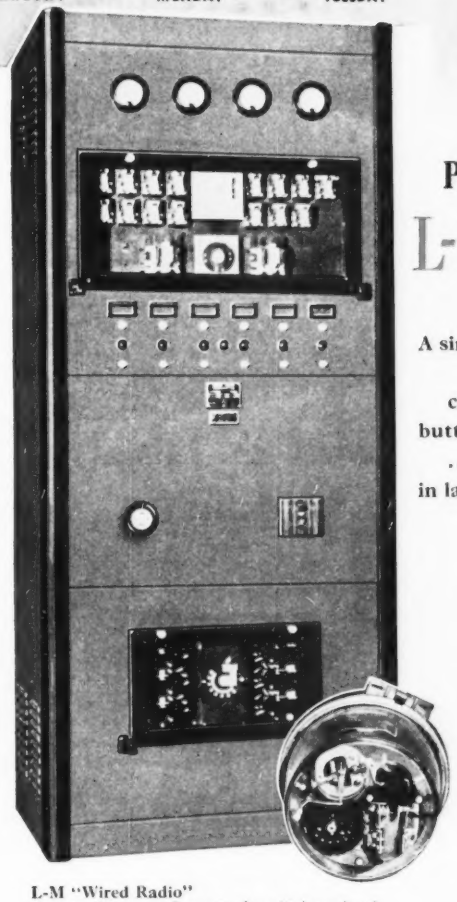
On the Pacific Coast Bethlehem products are sold by
Bethlehem Pacific Coast Steel Corporation
Export Distributor: Bethlehem Steel Export Corporation

BETHLEHEM STEEL

Load curve meets "Wired Radio"... load curve loses peaks . . . valleys are levelled!



Black line: Original load curve—note extreme peaks and valleys. *Red line:* Load curve after four groups of water heaters were put under L-M "Wired Radio" control. Costly peaks were cut 200 kw, valleys were levelled, leaving 200 kw of peak capacity for future growth.



L-M "Wired Radio" transmitter, and control unit (receiver)
Just push any one of the twelve buttons . . . the transmitter automatically sends out the signal. No pilot wires, no complicated operation.
Control unit operates the individual heater, group of lights, or other load. No tubes, no clocks—only a simple filter circuit. Quickly adjusted to operate on any one of the six signal groups, regardless of location.

Put your loads where you want them...with

L-M "Wired Radio" Control

A simple, flexible method for remote control of water heaters, street lights, and other loads...with low voltage 3000-cycle carrier current sent over your present lines. Simple push-button operation...easily installed...practically no maintenance ...pays for itself in 3 to 5 years. Many 8-10 year installations in large and small cities. Better than 99.9% correct operation.

Push a button—and the automatic transmitter at substation sends out a low voltage 3000 cycle carrier current signal coded for any one of 6 groups of loads. This signal goes wherever the 60-cycle current goes, without interference; but it operates only the group you selected.

You can turn any group of water heaters on or off at any time, spreading the load over profitable off-peak periods. That eliminates peaks caused by clock control. You control street lights manually or by photo-cell, in any desired group. You can thus take full advantage of the many economies of multiple street lighting.

No pilot wires, no clocks, no tubes, no trouble; just a practical, proved control system that works!

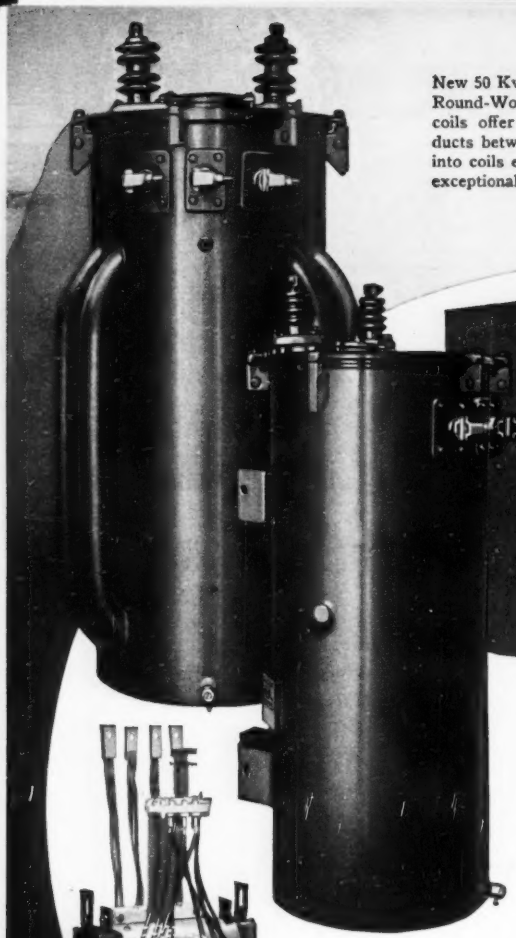
Releases distribution and generating capacity by cutting peaks before they occur. Get the lowdown! **Ask the L-M Field Engineer, or write Line Material Co., "Wired Radio" division, East Stroudsburg, Penna.**

WIRED RADIO CONTROL LM

LINE MATERIAL "Wired Radio"

L-M DISTRIBUTION EQUIPMENT INCLUDES:

Distribution Transformers • Fuse Cutouts and Fuse Links • Lightning Arresters • Oil Switches • Pole Line Hardware • Line Construction Specialties • Underground Equipment • Fibre Conduit • Street and Airport Lighting Equipment • "Wired Radio" Control Equipment • Capacitors



New 50 Kva (left, back) and 37½ Kva Round-Wound transformers. Round coils offer more cooling surface; oil ducts between core and coil and built into coils eliminate hot spots and give exceptional short time overload capacity before excessive temperatures are reached. White dotted line in core-coil assembly (lower left) indicates shape of the wound silicon-steel strip core which reduces weight and improves performance characteristics.

ROUND COILS WOUND CORE

L-M ROUND-WOUND CONSTRUCTION MAKES 37½ and 50 KVA TRANSFORMERS

33⅓% lighter-

with improved short-time overload characteristics

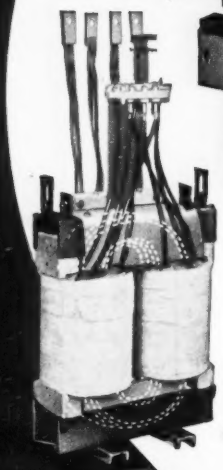
L-M's famous Round-Wound construction is now available in 37½ and 50 Kva sizes. These new sizes have round coils wound directly onto the wound core. They offer all these advantages:

Weight reduced 33⅓% — with improved short time overload characteristics because of better cooling.

Balanced Performance — lower exciting current, better ratio of losses, improved regulation, lower impedance.

Longer service life through higher average impulse strength, and greater short circuit strength inherent in the round cross section coil.

New round tanks with all the latest L-M improvements in weather-resistant paint, moisture-tight covers and bushings, and L-M accessories.



Write for this Bulletin

Illustrates details of Round-Wound construction, describes L-M research and test facilities, and features and performance of L-M Distribution Transformers. Write Transformer Division, Line Material Company, Zanesville, Ohio.

L-M Round-Wound Transformers are made in 1½ to 50 Kva, in all distribution class voltages including 14,400 volts, and meet EEI and NEMA standards.

LINE MATERIAL
TRANSFORMERS

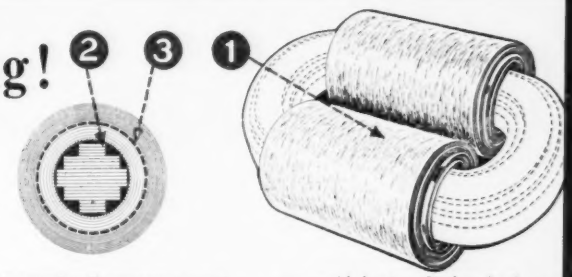
L-M DISTRIBUTION EQUIPMENT INCLUDES: **Distribution Transformers • Fuse Cutouts and Fuse Links • Lightning Arresters • Oil Switches • Pole Line Hardware • Line Construction Specialties • Underground Equipment • Fibre Conduit • Street and Airport Lighting Equipment • Wired Radio Control Equipment • Capacitors**

A "Balanced Performance" Feature

GET high short-time overload capacity with L-M Round-Wound Transformers because of this 1-2-3 better cooling!

Here's what you get in the "Balanced Performance" of L-M Round-Wound design

1. Higher average impulse strength.
2. High short-time overload capacity.
3. High short circuit strength because of the round coils.
4. Increased revenue with better-than average regulation.
5. Improved ratio of losses with lower total loss.
6. Low exciting current compatible with other performance characteristics.
7. Lighter weight with no sacrifice of mechanical strength or adequate cooling capacity.



1, long round coils expose a maximum of surface to cooling oil

2, wound core with stepped cross section provides cooling oil passages between core and coils

3, oil duct spacers wound into coils provide cooling through the coils on larger sizes

. . . resulting in exceptional cooling . . . with low copper temperatures, fundamentally necessary for *high short-time overload capacity*

If you must overload 'em, L-M Round-Wound transformers have a *high thermal recovery* rate. Their superior 1-2-3 cooling characteristics insure rapid heat radiation back to normal temperatures to enable handling of repetitive peak loading conditions.

High short-time overload capacity is another plus in the "Balanced Performance" L-M Round-Wound transformers provide.

It's More Fun to Know

New Bulletin 16-G-1 gives general details of design and construction of L-M distribution transformers—and it's not bad reading either! Other bulletins cover special types. Ask for the information you want. **Write Transformer Division, Line Material Company, Zanesville, Ohio.**

LINE MATERIAL Transformers

L-M DISTRIBUTION EQUIPMENT INCLUDES: Distribution Transformers • Fuse Cutouts and Fuse Links • Lightning Arresters • Oil Switches • Pole Line Hardware • Line Construction Specialties • Underground Equipment • Fibre Conduit • Street and Airport Lighting Equipment • "Wired Radio" Control Equipment • Capacitors

These L-M Power Fuse Cutouts

handle 7.5 to 46 Kv. . . . 100 and 200 ampere ratings

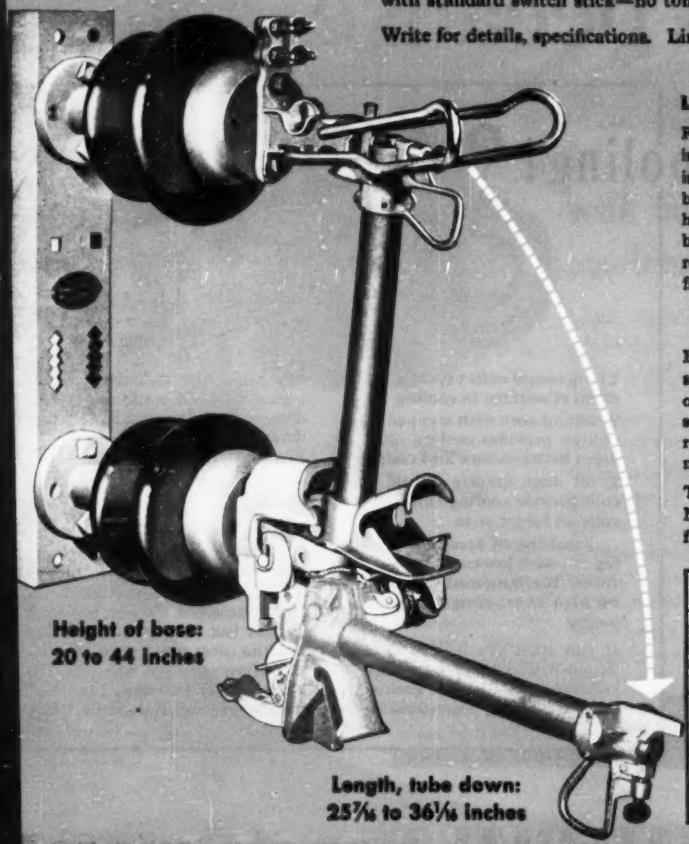
with interrupting capacities up to 6000 amperes

For heavy currents at or near substations . . . for transmission lines . . . wherever high voltage, high rupturing capacity cutouts are required.

A fuse cutout using standard field replaceable fuse links. Upper and lower venting. Simple, positive operation. Link flip-out release double lower hinge. No excessive strain on link. Unique wire spring contact design provides firm contact, free floating action with positive latch at top of tube. No shunts or other current transfer means. For re-fusing, cartridge can be lifted off hinge with standard switch stick—no tongs or special sticks needed.

Write for details, specifications. Line Material Company, Milwaukee 1, Wis.

Length, tube up:
20¾ to 31½ inches



Height of base:
20 to 44 inches

Length, tube down:
25⅞ to 36⅛ inches

L-M Replaceable Power Fuse Links

Field replaceable standard links similar in design and construction to types used in distribution cutouts. No cartridge to buy, no filler tubes to bother with. Links have tin fusible element; strain wire; butt-soldered to top button and lower rod terminal. Long fibre tube housing from button to flexible leader.

Cutaway view of 200 ampere link

Double-Venting Feature

Button closes top of cutout tube. Side spring contacts permit button to blow off under heavy shorts, releasing pressure at both ends of tube. Eliminates recoil and stresses on contacts and mountings.

Time current characteristics conform to NEMA "E" standard SG-11 for power fuse links.

RUPTURING CAPACITIES		
Voltage	Type HFO 100-amp rating	Type HXO 200-amp rating
7500 volts	4000 amps	6000 amps
15000	4000	6000
23000	4000	6000
34500	2000	4000
46000	2000	4000

LINE MATERIAL

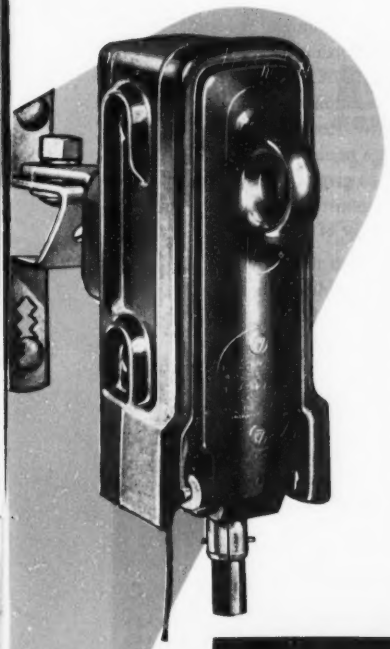
FUSE CUTOUTS & FUSE LINKS

L-M DISTRIBUTION EQUIPMENT INCLUDES: Distribution Transformers • Fuse Cutouts and Fuse Links • Lightning Arresters • Oil Switches • Pole Line Hardware • Line Construction Specialties • Underground Equipment • Fibre Conduit • Steel and Airport Lighting Equipment • Wired Radio Control Equipment • Capacitors

One minute re-fusing... even with gloved hands

one of the many features of

L-M "PVD" Fuse Cutouts



Seconds count in restoring outages . . . seconds are saved in re-fusing "PVD'S." Door is unhooked, re-fused, and replaced in a minute or less, on the pole, even with gloved hands. Or the lineman hooks on a spare fused "PVD" door and closes it—in 6 seconds—if he's really in a hurry.

Regardless of weather, you can depend on the instant, positive action of L-M "PVD" 56 Fuse Cutouts. The door remains shut, keeping out the weather; but the cartridge drops, while the link flip-out device separates blown link parts quick as a wink. Dropped tube enables lineman to spot blown fuses in a hurry.

No arcing between the heavy silvered contacts; operation is independent of door; rain-shed design of the wet process porcelain housing sends the rain on about its business and keeps the inside dry as a bone! Over a million "PVD's" have been sold—years of dependable operation. For more information on these or other closed or open type L-M Fuse Cutouts, ask the L-M Field Engineer for Bulletin, or write **Line Material Company, Milwaukee 1, Wisconsin.**

Four Sizes: 5000V Delta, 50 and 100 amps; 7500/12500V Gr. Y, 50 and 100 amps.

Or would you rather have the door drop open?

"PVD" 561 also opens the door, when the fuse blows. Personally we'd rather have the door stay shut and keep the weather out—but some folks like the extra indicating feature—and here it is—with all the other good features of regular "PVD" 56's.

LINE MATERIAL Fuse Cutouts

L-M Distribution Equipment Includes:

Distribution Transformers • Fuse Cutouts and Fuse Links • Lightning Arresters • Oil Switches Pole Line Hardware • Line Construction Specialties • Underground Equipment • Fibre Conduit • Street and Airport Lighting Equipment • "Wired Radio" Control Equipment • Capacitors

DON'T SAY "ANTIMONIAL ADMIRALTY"—

SAY "CHASE ANTIMONIAL ADMIRALTY"

It could well mean a great saving to you.

You see, the minimum percentage of antimony set forth in Chase Patent No. 2,061,921 is .007%. Under certain mild exposure conditions this quantity would prove effective. However, experience has shown that a minimum of about .015% is essential to give reasonably complete protection against dezincification under the entire range of conditions.

To assure you this .015% minimum, Chase manufacturing processes incorporate nominally .035% antimony in their admiralty. Why risk tube failures when you can specify *Chase* Antimonial Admiralty, *which costs you no more than plain Admiralty*. Write or call your nearest Chase Warehouse or Sales Office today, listed below.

Special stocks of ANTIMONIAL ADMIRALTY Condenser Tubes in Chase Warehouses: BALTIMORE, NEW ORLEANS LOS ANGELES, SAN FRANCISCO *also carried by*— Vinson Supply Co., Tulsa Standard Brass & Mfg. Co., Houston

Chase

the Nation's Headquarters for BRASS & COPPER

WATERBURY 91, CONNECTICUT — SUBSIDIARY OF KENNECOTT COPPER CORPORATION

THIS IS THE CHASE NETWORK . . . *handiest way to buy brass*

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ACCURATE TAPES

WORK BETTER
—because they're made better!

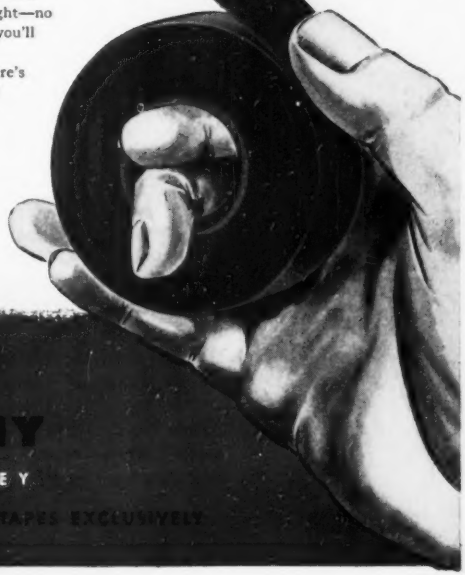
Every package of ACCURATE tape helps you produce better taped joints in less time. You know this as soon as you've stripped the first length off a new roll. The tape peels off straight and neat without ravelling —tapes up tight and even on the joint —and breaks clean right where you tear it. ACCURATE tapes work better because they're made by men who specialize in tape making.

TAKE A GOOD LOOK AT THE TAPE YOU USE—

—if it's

ACCURATE TAPE
here's what you'll find!

First you'll see proper protective packaging. Substantial protective carton; heavy cellophane wrapper inside. Hold a length to a bright light—no pinholes anywhere. Then, when you use it, you'll notice ACCURATE tape never creeps or ravels and breaks off straight and neat. There's more than meets the eye, too. Every foot of ACCURATE tape is made to ASTM Standards and every roll contains guaranteed footage. That's why—when you buy ACCURATE tapes—you get real tape value. Next time you need tape—order ACCURATE. Write for catalog and name of distributor nearest you.



ACCURATE MFG. COMPANY

GARFIELD, NEW JERSEY

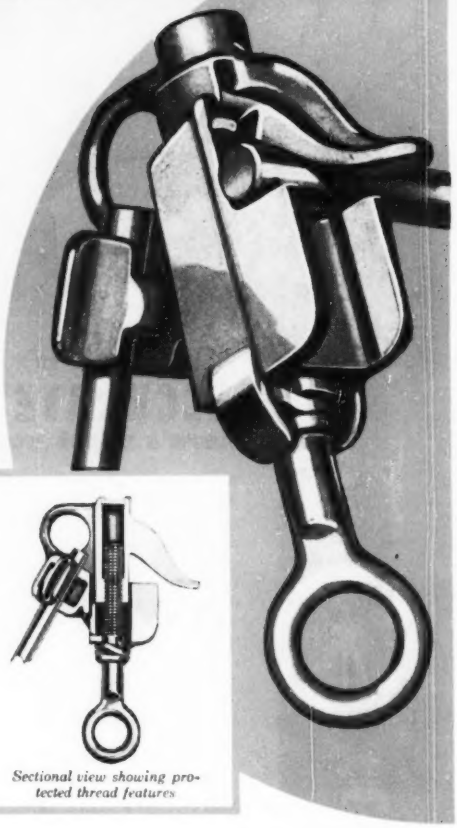
25 YEARS MAKING TAPES EXCLUSIVELY

Make Hot Line Taps

KEARNEY

For Easy Installation and Removal

Use KEARNEY CON-NEC-TAP CLAMPS with Protected Threads



Sectional view showing protected thread features

The operating screw travels in a waterproof chamber filled with corrosion-resistant lubricant. This construction keeps unused portion of threads clean and insures easy operation of screw, preventing binding or freezing of clamp to conductor.

TIGHT CONNECTION WITHOUT DAMAGE TO CONDUCTOR — A heavy radius on upper and lower contact jaws gives a bell mouth contact, which prevents any damage to conductor due to line vibrations.

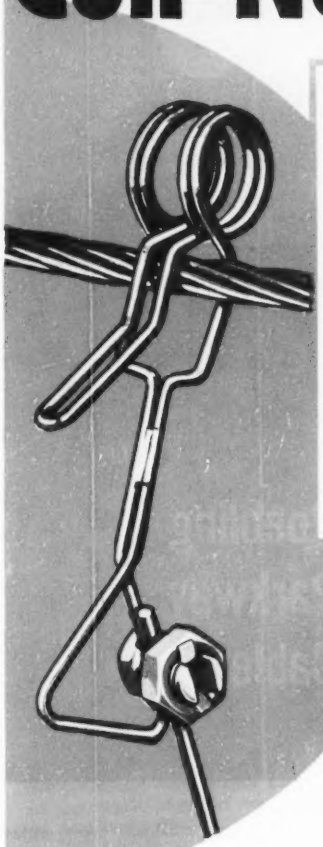
CONNECTIONS STAY TIGHT IN SERVICE — A strong spring between operating screw and lower contact jaw prevents clamp loosening from vibration, and serves to take up expansion or contraction of conductor or clamp which may be caused by temperature changes or adjustment of conductor strands.

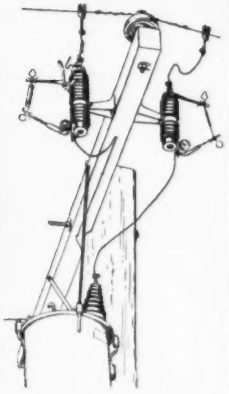
For lighter loads use this smaller model

These Kearney Clamps will reduce your maintenance costs because their service life is longer. They are easy to install with standard clamp sticks and they may be salvaged for use over and over.

Safely, Efficiently with

Con-Nec-Tap Clamps





A Kearney Trip-O-Link and lightning arrester on a rural installation

Tap small transformers or lightning arresters with this Spring Con-Nec-Tap Clamp. The copperweld wire in this clamp is especially formed and wound to exert a resilient high pressure, durable contact. Available in three styles — copper to copper, aluminum to copper and all purpose cadmium plated.

ARMOR ROD CON-NEC-TAP CLAMP — These clamps are for use over armor rods and large conductors in a range from No. 6 A.C.S.R. to 397,500 C.M. A.C.S.R. over armor rods. The large screws and jumper lugs, provided with SAE threads, guarantee that the clamps will remain tight on the conductor and jumper. Available for various combinations of connections on like and unlike metals.

FOR BETTER CONSTRUCTION AND MAINTENANCE

Always Specify KEARNEY PRODUCTS *for the Job*

JAMES R. KEARNEY CORPORATION ST. LOUIS, MO.

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Canadian Plant, James R. Kearney Corp., Ltd., Leaside, Ontario, Canada

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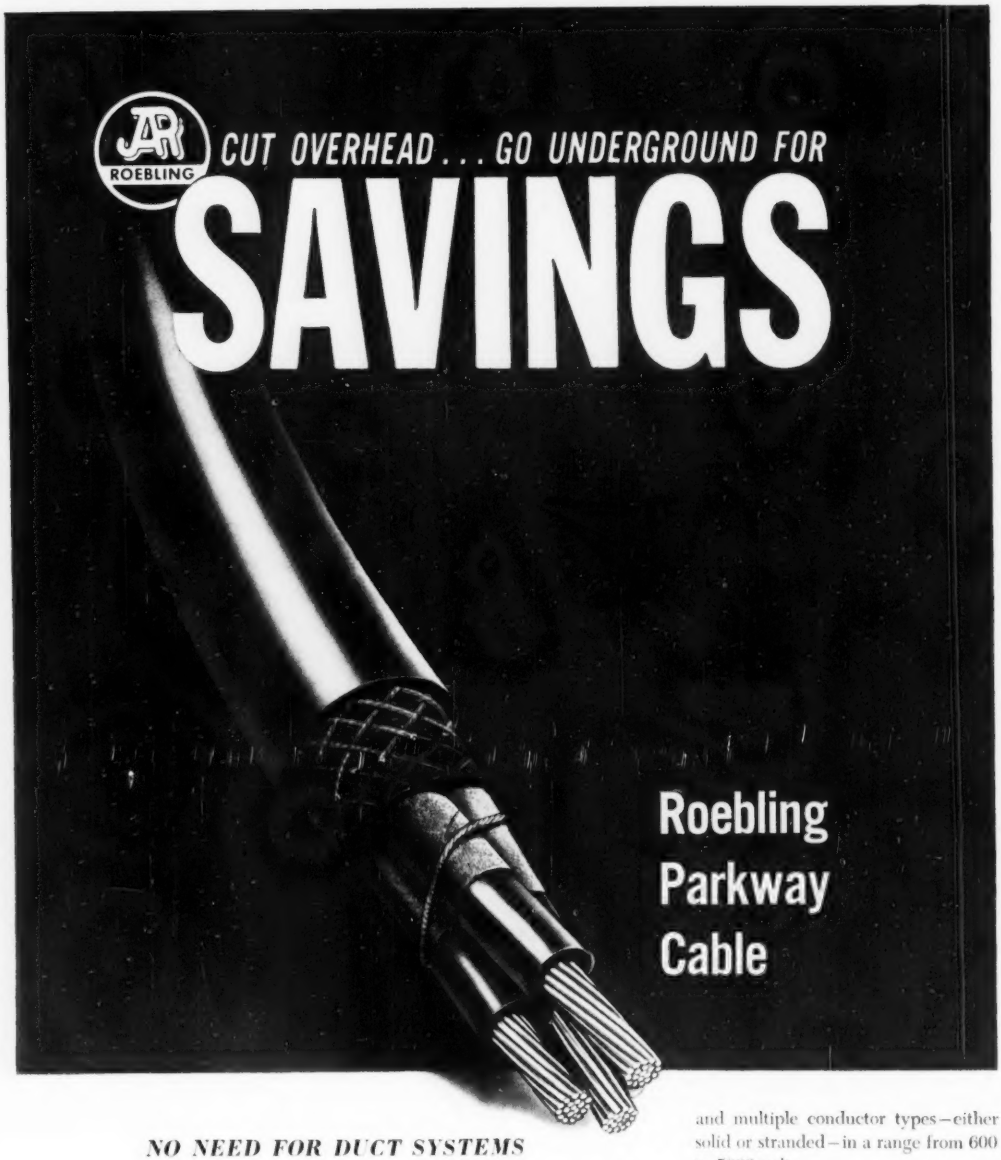
JR ROEBLING

CUT OVERHEAD . . . GO UNDERGROUND FOR

SAVINGS



NO NEED FOR DUCT SYSTEMS

ROEBLING PARKWAY CABLE is laid directly in the ground. No complicated and costly duct systems . . . a trench only two or three feet deep is ample and economical. Once installed, you can count on Roebling Parkway for trouble-free and uninterrupted service.

You have the choice of Roebling Parkway Cable with metallic armor or with a non-metallic, roeprene sheath that affords dependable physical protection. Both can be supplied in single and multiple conductor types—either solid or stranded—in a range from 600 to 5000 volts.

Your nearest Roebling distributor or Roebling office will be glad to help you select the best cable for your particular requirements. Call on them for any desired assistance. John A. Roebling's Sons Company, Trenton 2, New Jersey.

WRITE OR CALL THE ROEBLING FIELD MAN AT YOUR NEAREST ROEBLING OFFICE AND WAREHOUSE

Atlanta, 934 Avon Ave. ★ *Boston*, 51 Sleeper St. ★ *Chicago*, 5525 W. Roosevelt Rd. ★ *Cleveland*, 701 St. Clair Ave., N. E. ★ *Denver*, 1635 17th St. ★ *Houston*, 6216 Navigation Blvd. ★ *Los Angeles*, 216 S. Alameda St. ★ *New York*, 19 Rector St. ★ *Philadelphia*, 12 S. 12th St. ★ *Pittsburgh*, 355 W. North Ave. ★ *Portland, Ore.*, 1032 N.W. 14th Ave. ★ *San Francisco*, 1740 17th St. ★ *Seattle*, 900 First Ave.

ROEBLING

☆ A CENTURY OF CONFIDENCE ☆

Now it's easy to say Goodbye to Guesswork

You get the Right truck . . . the Complete truck . . . on just One Order . . . when you use FWD's simple BUILT-TO-CODE chart to select the FWD motorized unit you need

ONE UNIT . . . one order . . . one responsibility! Yes, FWD's handy *built-to-code* chart makes your selection of line construction and maintenance trucks that simple . . . that trouble-proof. And here's why —

You quickly see the 38 varying — yet standardized — combinations that are available and the specific equipment each FWD carries.

You easily order the FWD you want because each unit is designated by an individual code number.

You issue only one order because FWD engineers and builds the *complete* unit — truck and equipment. That's why — when your FWD is delivered — it's ready to go to work immediately.

What's more — with FWD supplying the complete unit — buck-passing is eliminated. FWD accepts full responsibility.

Let FWD's code chart help simplify your equipment purchases. See Graybar or write us direct.

THE FOUR WHEEL DRIVE AUTO CO.
CLINTONVILLE, WISCONSIN
Canadian Factory: KITCHENER, ONTARIO

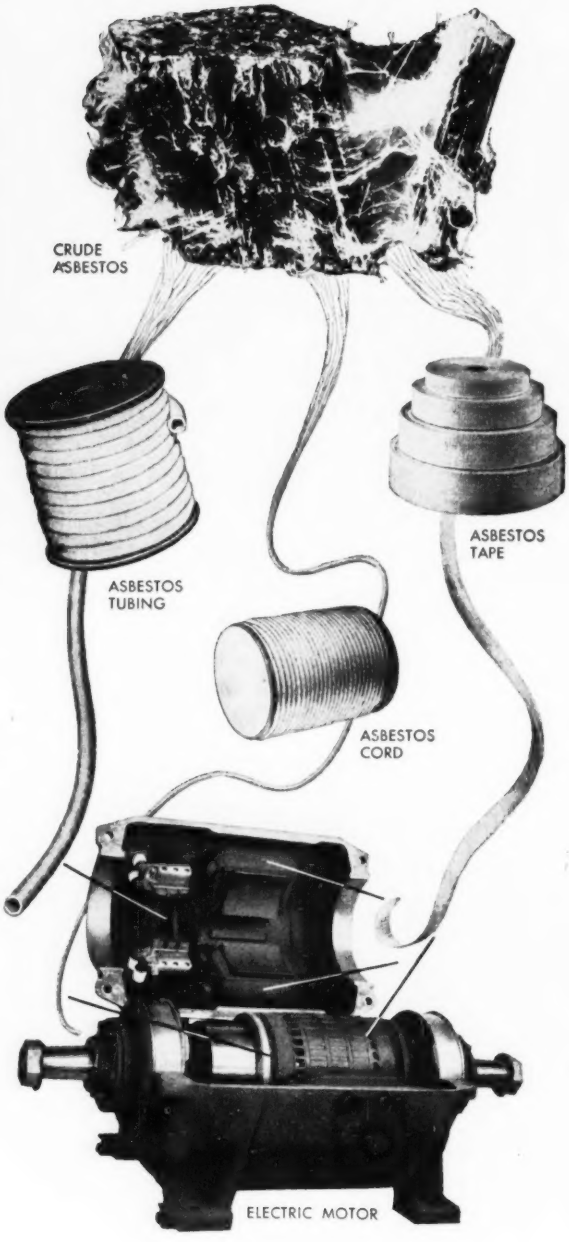
Built-to-Code
MOTORIZED UNITS
For Line Construction and Maintenance

Built by

Makers of America's Foremost Heavy Duty Truck

Distributed by Graybar

Protection woven from *The Magic Mineral*



In the line of K&M Asbestos Textiles you'll find a complete range of materials to suit the most exacting electrical insulation needs. K&M Asbestos Textiles meet ASTM specifications and are supplied to the electrical industry in the form of Thread, Twisted Cord, Braided Tubing, Woven Tapes, and Cloths.

Request our help on any insulation problem where K&M Asbestos Textiles might be the solution.

Nature made Asbestos...
Keasbey & Mattison has made it serve mankind since 1873

K&M best in asbestos ®

KEASBEY & MATTISON
COMPANY • AMBLER • PENNSYLVANIA
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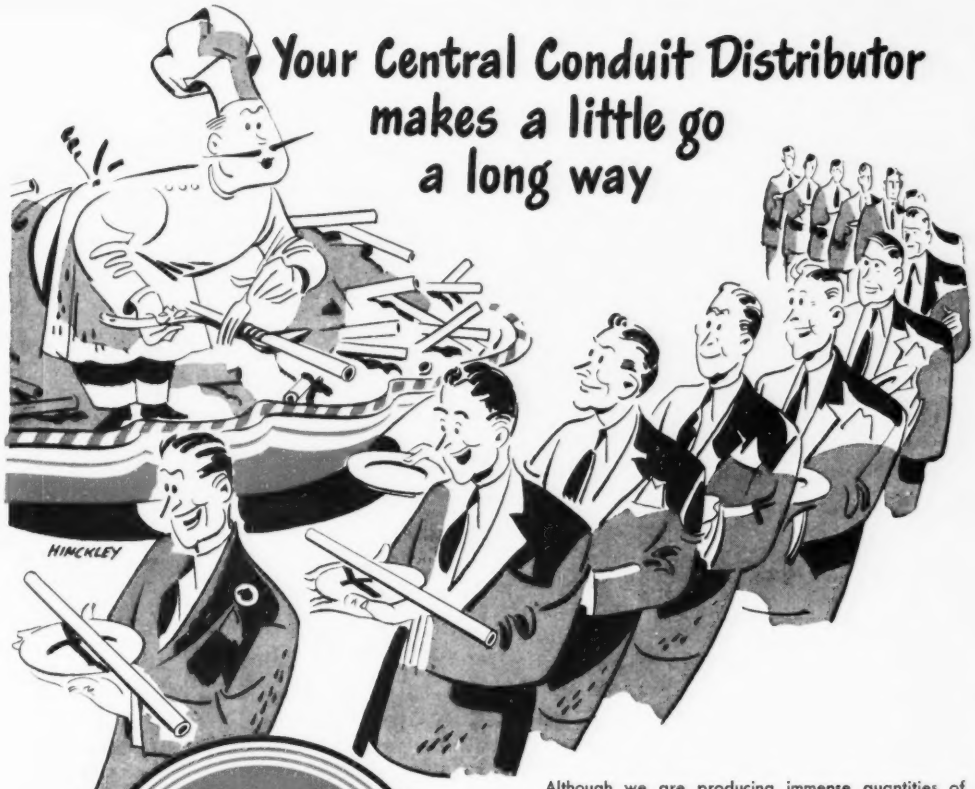
Your Central Conduit Distributor makes a little go a long way



CENTRAL
~~SPANG~~
CONDUIT

Although we are producing immense quantities of Central Rigid Steel Conduit, there just isn't enough to meet today's tremendous demand for it. Consequently, there may be times when your distributor will be unable to fill your complete order immediately.

But to make his limited supply go a long way, your Central Rigid Steel Conduit Distributor often makes partial deliveries. That's his way of making sure that you get a fair share of his supply.

Keep in touch with your Central Rigid Steel Conduit distributor. You will find him a dependable source for all kinds of electrical supplies.

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CENTRAL WHITE electro-galvanized outside and black enameled inside.

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Division of The National Supply Company
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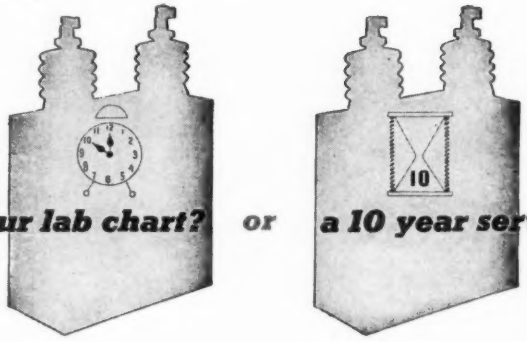
how do you
select a capacitor for
dependability . . .

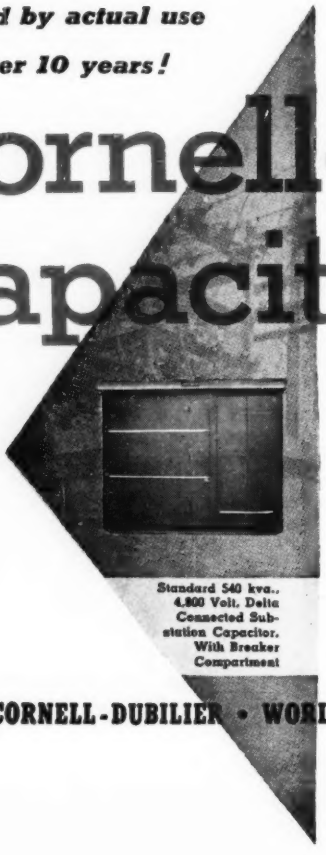


by a 10 hour lab chart? ***or*** ***a 10 year service report?***

it's a fact
proved by actual use
for over 10 years!

cornell-dubilier capacitors

for power-factor improvement



Standard 540 kva., 4,800 Volt, Delta Connected Substation Capacitor, With Breaker Compartment

Time is the surest of all capacitor test yardsticks. Not by hours — but by 10 years of field service as achieved by Cornell-Dubilier Capacitors wherever installed for power-factor improvement. Field service records of more than 3,500 major installations — over 800,000 kva. — offer you proof too that C-D is preferred for its long life and dependability in actual use. Call in a seasoned C-D engineer to analyze your power-factor requirements. Cornell-Dubilier Electric Corporation, Dept. D-9 South Plainfield, New Jersey. Other plants in New Bedford, Worcester, Brookline, Massachusetts; and Providence, Rhode Island.

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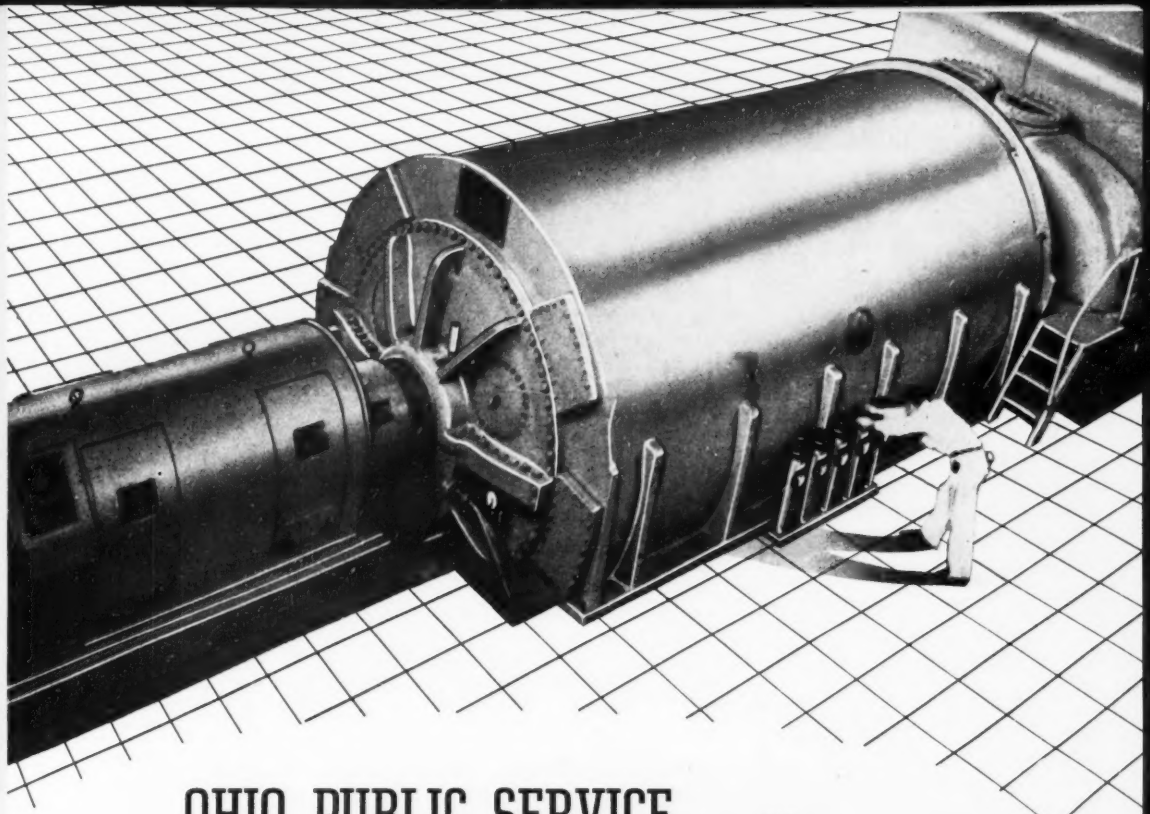


OHIO PUBLIC SERVICE *specifies*

HONAN-CRANE for Turbine Oil Purification in 5 plants

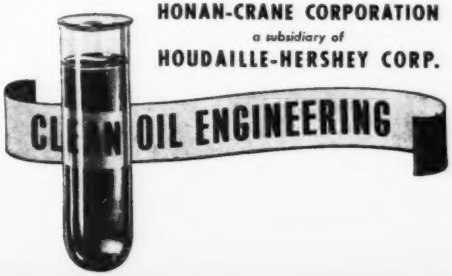
The Ohio Public Service Company has used Honan-Crane oil purification equipment continuously for seven years, now has Honan-Crane installed in five of its big Ohio generating stations which produce a total of 470,000 kilowatts.

Ohio Public Service first installed a Honan-Crane purifier in the Mahoningside station at Warren, Ohio, in December, 1941, and since that time has purchased additional purifiers for generating stations located at:

R. E. Burger Station	**Dilles Bottom, Ohio**	**230,000 kw**
Edgewater Station	**Lorain, Ohio**	**100,000 kw**
Mahoningside Sta.	**Warren, Ohio**	**82,000 kw**
Scioto Station	**Marion, Ohio**	**38,000 kw**
Melco Station	**Mansfield, Ohio**	**20,000 kw**

Using Cranite (specially processed fullers earth), stations are able to operate continuously with turbine oil held to safe, low neutralization and steam emulsion numbers. At the R. E. Burger station a variable schedule of purification has been established. Cellulose fibre is used as the regular filtering medium and is replaced by Cranite where the S. E. or neut numbers rise above specified limits. This more economical plan of purification is easy to accomplish because of the flexibility of Honan-Crane purifiers in accommodating either type of filtering media.

Honan-Crane oil purification equipment maintains Turbine oil in its original clean condition, removing oil contaminants as rapidly as they appear. Maximum turbine operating efficiency is possible and safe use life of oil extended because Honan-Crane purifiers give control over type of contamination that causes neutralization and S. E. numbers to rise beyond desired limits. For complete information on turbine oil purification, and Honan-Crane oil purifiers, write to 819 Wabash Avenue, Lebanon, Indiana.



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a subsidiary of
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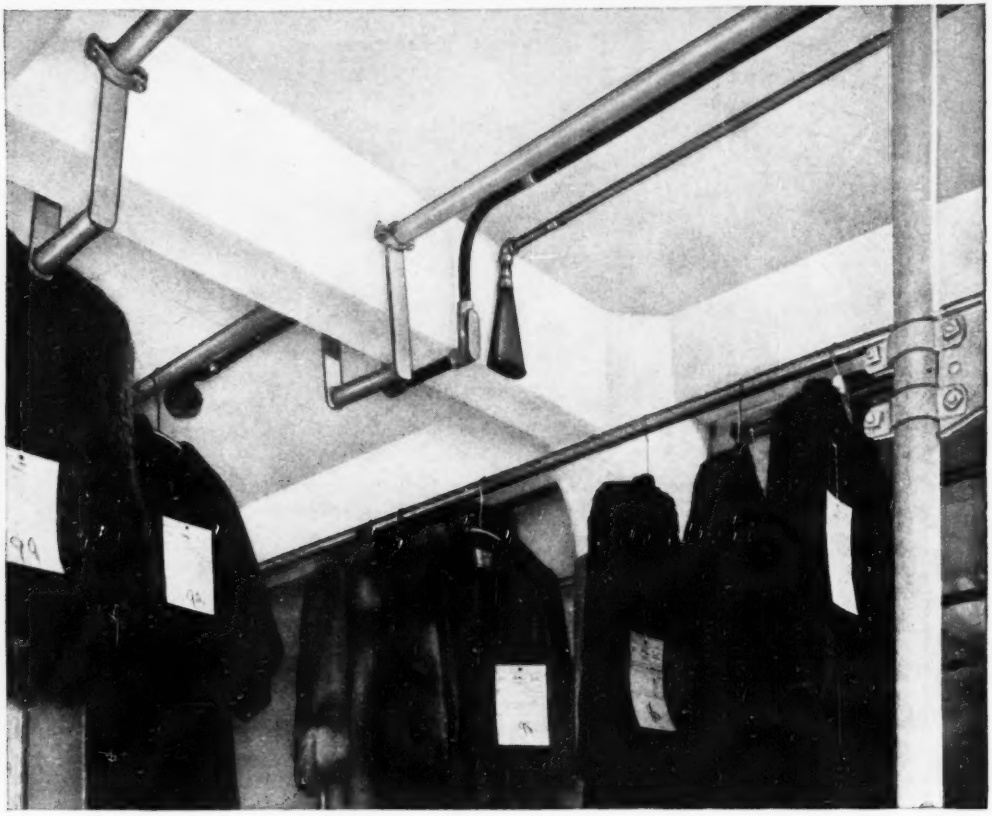
There's a cool $10,000,000 here...



—that won't go up in smoke!

Pack hundreds of costly furs into a storage vault—and you have an investment that takes a whale of a lot of watching!

At Merchants Transfer & Storage Co., Washington, D. C., the electric eyes of *Kidde* Smoke Detectors are *constantly* on watch. Supplemented by Heat Actuators, they send a *Kidde** automatic fire-extinguishing system into action at the first threat of fire. The system smashes the threat by flooding the vault . . .

With *water?* Not on fur coats that would turn into sodden masses! No, the *Kidde* system uses dry, clean carbon dioxide (CO_2) that's deadly to *fire*, harmless to *materials*.

The places in *your* plant where you store business documents—contracts, deeds, drawings, formulas, important correspondence—present fire hazards much like fur vaults. Your valuable papers *need* fire protection—but they're useless if water-soaked! For applications like this, CO_2 is the ideal extinguishing agent . . .

And when you think of CO_2, call Kidde!

*Also known as "LUX."

The words "Kidde" and "Lux" and the Kidde seal are trade-marks of Walter Kidde & Company, Inc.

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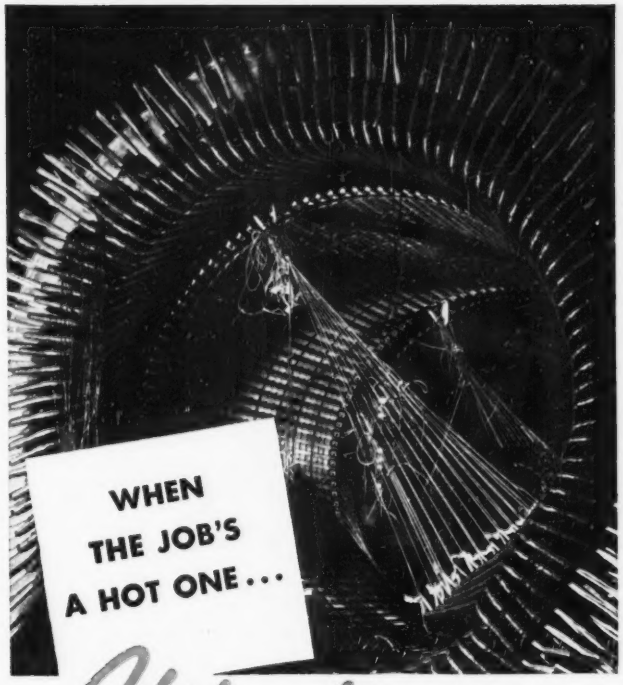

Wire it

WITH DELTABESTON*

When busy motors won't permit "cooling off" periods, where motor overloading is unavoidable, where motors can't escape high ambient temperatures, wind them with Deltabeston magnet wire. Heat-beating Deltabeston is built to "take it" in places where temperatures are really hot.

The specially impregnated-asbestos or varnished-glass-yarn insulations of Deltabeston magnet wires won't bake out. Both types of insulation are bonded to the soft-copper conductor by a special heat-resistant insulating varnish that provides a perfect bond between the copper and the insulation. The copper exceeds the accepted standards of ASTM for purity, conductivity, and temper. Tough, flexible Deltabeston magnet wire—in round, square, or rectangular cross-section—meets your needs for the most intricate winding applications.

But get the whole Deltabeston story! We've compiled it in an interesting booklet that includes a handy table to simplify selection. For your free copy, just fill in and mail the coupon below.

*TRADE-MARK REG. U.S. PAT. OFF.

GENERAL ELECTRIC

HI-AMBIENTS

Application hints on the complete Deltabeston Line

POWER CABLES—The complete Deltabeston line gives you a full range of power cables for applications up to 5000 volts. In lead sheath—with black-finished asbestos braid—or in lead sheath and interlocked armor, all types have the famous felted-asbestos insulation for long service at continued high heats. Choose the power cable you need from the Deltabeston line for resistance to flame, heat, moisture, oil, vapors, or grease.

FIXTURE WIRES—Fluorescent and incandescent fixture installations need the heat protection of Deltabeston Type AF fixture wire. Use it to keep lighting systems in service; to cut maintenance to a new low. You'll like Deltabeston Type AF fixture wire for its workability, too. It's flexible and easy to strip, clean to work with. Ask your General Electric merchandise distributor for samples.

BOILER-ROOM WIRE—Exposed wiring, in installations where heat and moisture are a constant threat, calls for Deltabeston boiler-room wire. It's built for copper temperatures up to 125 C (257 F). It's built to resist heat, flames, and grease. Specify it by name—Deltabeston boiler-room wire—for extra heat protection.

ELECTRIC STOVE WIRE—For wiring or rewiring electric stoves, your best bet is Deltabeston electric stove wire. Smokeless and moisture-resistant types take the day-in, day-out beating of continued heat. For more information, write to Section Y29-227, Construction Materials Department, General Electric Company, Bridgeport 2, Connecticut, and ask us for the free booklet, *Deltabeston Wires and Cords*.

DELTABESTON
Wires and Cables
built to beat the heat

Section Y29-227,
Construction Materials Department
General Electric Company, Bridgeport 2, Conn.

Please send me the free booklet on heat-beating Deltabeston magnet wires.

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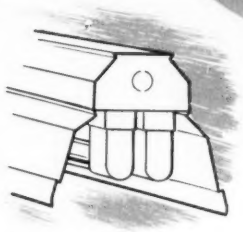
Rounding out the line of

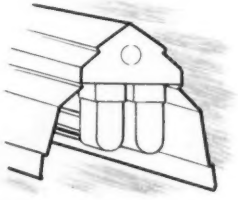
Wheeler
"SKILLED LIGHTING"

...New SLIMLINE Fluorescent Fixtures



INDUSTRIAL UNITS

End view of industrial type unit showing flat top. These units are designed for general industrial use under normal atmospheric conditions.



TEXTILE UNITS

End view of textile mill unit showing peaked top especially designed to eliminate frequent cleanings and to offer outstanding protection against humidity.

THIS SMART-LOOKING SLIMLINE fixture offers you more than just sleek beauty . . . it also offers a genuine "Skilled Lighting" unit for use with the new high efficiency SLIMLINE Lamps. Assures extra long service life with minimum maintenance.

Typical of Wheeler engineering thoroughness is the exclusive auxiliary lamp support at center of the fixture to prevent vibration of the 8 foot lamps. Fixture channel is in one piece . . . available in either baked enamel or Wheeler triple-guarded *vitreous porcelain enamel* finish. Reflectors are furnished in vitreous porcelain enamel finish only.

TWO TYPES: INDUSTRIAL-TEXTILE

The new Wheeler SLIMLINE is made for regular industrial application or for textile mill application. Textile mill units have peaked channels to prevent accumulation of fly, lint, dust and moisture.

HIGHEST EFFICIENCY

SLIMLINE lamps operate at the highest efficiency of any lamps. They start instantly . . . no special ballasts needed. If increased intensity is desired, 300 MA ballast is available to replace 200 MA ballast using same lamps.

EASIEST TO HANDLE

SLIMLINE fixtures have only 2 sockets . . . lamps have only 1 terminal pin in each end. Only two 8 foot lamps for a double-length fixture. Get all the facts on the extra value of these new SLIMLINE Units. Write to **Wheeler Reflector Company, 275 Congress St., Boston 10, Massachusetts.**

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Wheeler REFLECTORS

SKILLED LIGHTING

MADE BY SPECIALISTS IN LIGHTING EQUIPMENT SINCE 1881

TROUBLE

...When you least expect it
And can't afford it

STOP POLE DECAY...

with OSMOPLASTIC groundline treatment

● Rain, a sudden dropping, zero-bound thermometer and then snow. A whirling, swirling, blinding mass of white that completely immobilizes operations. Tons of ice form on lines... and the "sticks" start coming down.

That's a condition every utilities man knows and dreads. It not only impairs service and causes untold hardships to subscribers but it *skyrockets operating costs.* Yet...in many cases, it can be prevented with Osmoplastic groundline treatment. Osmoplastic is a concentration of toxic salts, suspended in a coal tar body. When applied to the groundline area of the pole and covered with a special "bandage", the salts penetrate DEEP into the pole, destroying all fungi and preventing further decay for years to come. Employed by prominent utility companies everywhere, Osmoplastic is the simple, inexpensive but effective way to add EXTRA life to all your standing poles.

Let us submit estimates and explain how *our experienced field crews can handle this work for you* at surprisingly low cost. Or, if you prefer, we will supply the materials for your own application. Osmose Wood Preserving Company of America, Incorporated, Buffalo 12, New York.

Send for this
FREE BOOKLET

Get the facts! Find out how you can save your standing poles for a nominal service charge. Write for this free booklet "How to keep your Poles UP and Costs DOWN!"

OSMOSE WOOD PRESERVING COMPANY OF AMERICA, INC.

"Give us the tools . . ."

McGraw-Hill Surveys BUSINESS NEEDS

If it can get the money American industry in 1949 will go full steam ahead with a vitally-needed program of improving its facilities. This program since V-J Day has kept business expanding and has made belated headway in modernizing industry.

Furthermore, if it can get the money American industry will carry on for the next five years with its unprecedented program of expenditure for new plant and equipment. Plans already made call for spending about $55 billion.

These are findings of the McGraw-Hill national survey of "Business' Needs for New Plants and Equipment." Major results of the survey, which have been rechecked since election day, are summarized on the following page. They report what American industry is now planning to spend for new plant and equipment. *They do not and cannot show what will be done if the plans are hamstrung by political action.*

In 1949, the survey shows, American industry plans to spend $14.1 billion for new plants and equipment. That is only about 5% less than was actually spent in 1948.

If these plans are carried out, actual capital expenditures this year may be somewhat larger than they were in 1948. That is because expenditures usually prove to be larger than planned.

Fulfillment of American industry's plans for investment in new plant and equipment this year would no doubt mean a continuation of general prosperity. The record shows that when capital expenditures are high general business thrives.

Even more remarkable than the 1949 prospect is the fact that:

Industry already plans to spend $41 billion in the years 1950-53 to improve its plants and equipment.

Plans tend to taper off, of course, as they are pushed further into the uncertain future, five years from now. But the striking fact is that plans for expenditures so far ahead are as great as they are. They show American industry's need for tremendous improvements in its plants and equipment.

Again, let there be no mistake. These survey findings are not a five-year forecast. They report what leading corporations now are planning to do – *if they can get the money.*

But – won't industry be top-heavy with plants and equipment if it carries through any such program?

The answer is clearly – "No".

Here are some of the reasons why not that were disclosed by the McGraw-Hill survey:

First, manufacturing industries are shifting emphasis from expansion to improving efficiency.

They have increased their total capacity 56% since 1939. Their expenditures in 1948 went almost 50-50 for expansion and improvement. But in the next five years they plan to spend three-quarters of their funds to replace and modernize facilities, only one-quarter for expansion.

Second, the prospective rate of expenditure for new plant and equipment is relatively low.

Planned expenditures for new plant and equipment in 1949 represent about 7.5% of the present value of all plant and equipment. That rate of capital expenditure is no higher than the rate during previous periods of prosperity. And industry must overcome years of starvation for new equipment, caused first by the depression of the 30's, then by diversion to war production.

Third, industry is following an extremely cautious policy in buying new equipment.

Three out of four companies report that they will not buy equipment unless it will pay for itself within five years. And a third of the companies report that they expect new equipment to pay for itself within three years. The reason most frequently given for such expectations was that all the money available can be spent on equipment which does pay for itself quickly.

The program of capital expenditure planned by American industry is one of the greatest bargains ever offered to the American people.

To pay for itself in a few years, as equipment must if most companies are to consider buying it, that equipment

continued on next page

WHAT THE SURVEY SHOWS

● HERE ARE THE MAJOR FINDINGS of McGraw-Hill's survey of "Business' Needs for New Plants and Equipment". Rechecked since Election Day, results show what industry is now *planning* to spend for new plants and equipment. They do not forecast what will actually be spent. The survey shows:

1. Industry now plans to spend $14.1 billion in 1949 – and almost $41 billion in the four years beyond, 1950-53.
2. Manufacturing industries alone plan to spend $7.2 billion in 1949. This is 7.5% of the estimated value – $96 billion – of all manufacturing facilities.
3. Manufacturers estimate conservatively that it would cost $136 billion to completely replace their facilities with the most modern plants and equipment available.
4. Postwar expansion is virtually complete in most manufacturing lines. Major exceptions: steel and petroleum refining.
5. Expansion programs of railroads, utilities, and oil companies still have two to five years to run.
6. Manufacturing industries have increased their capacity 56% since 1939. But expansion is slowing down. Increase planned in the next five years is only 13%.
7. Efficiency is emphasized more and more in planning new facilities. Manufacturers plan to devote almost three-quarters of their funds to replace and modernize. In 1948, 58% went to increase efficiency this way.
8. Equipment should pay for itself in five years or less, say three out of four manufacturing companies. New buildings, say 77% of them, should pay out in 15 years or less.
9. Profits and reserves are counted on to pay for new buildings and equipment by three out of four manufacturing companies. Some 15% expect to borrow, only 9% plan to sell stock. However, 20% would like to sell stock, only 4% want to borrow.
10. More liberal depreciation allowances for income tax purposes would prompt almost two-thirds of the companies to speed their purchase of new plants and equipment.

● A copy of a complete report on "Business' Needs for New Plants and Equipment" may be obtained by writing me at McGraw-Hill Publishing Co., 330 West 42nd St., New York 18, N. Y.

must promise to produce much better products or make great savings in labor and material. The savings go first to the companies buying the equipment but, as they always have, they soon spread to everyone in the form of better products at lower costs.

Where does industry expect to get the money to buy this bargain for the American people?

Most of the companies covered by the McGraw-Hill survey (76% of the total) count on their own resources – largely profits – to pay for new plant and equipment. About 15% of them expect to borrow money, although only 4% like the idea of getting saddled with fixed debt. Only 9% of the companies expect to sell stock to investors, although twice that many report they wish they could.

What are the chances that business can get the money?

The survey provides no answer to that question. No survey can.

The answer will come from Washington – in what Congress does about taxes on profits and taxes on the millions of Americans who might invest a part of their income in industry's new plants and equipment.

The answer will be found also in the energy and skill shown by investment bankers, particularly in mobilizing the resources of the millions of Americans whose incomes have increased enough since 1940 to make them potential direct investors in industry.

Still another important part of the answer will be given by labor leaders. About half the companies surveyed by McGraw-Hill are holding back on new construction – primarily because of high costs. What organized labor does about wages and productivity can swell or shrink that percentage.

The McGraw-Hill survey leaves no doubt that American industry is fulfilling its responsibility. It is planning the capital improvements needed to make the nation secure, prosperous, and progressive.

But business today lacks confidence and badly needs added incentives. Proper taxation and increased depreciation allowances are vital if we are to open the capital markets to finance industry.

What will happen now depends in large part on what is done in Washington. In his State of the Union message, the President said that "business should plan for steady, vigorous expansion." But in his budget message he proposed new taxes which would divert a substantial share of the money industry is using for expansion and improvement. Moreover, he said nothing about the vital issues now freezing the capital markets.

It is not possible to have it both ways. Fulfillment of the President's tax program means cutting industry's program for new and better equipment. It means slowing down industrial progress. It means delaying the advance toward much higher standards of living tomorrow in order to have a little more government spending today.

I urge you to see that your Representative and your Senator have all the facts on industry's needs for new plant and equipment. What they do to this program will have a decisive bearing on the nation's security and welfare.

James H. McGraw, Jr.

President, McGraw-Hill Publishing Company, Inc.

This is the fourth editorial of a special series on industry's needs for new plants and equipment – and what these needs mean to all Americans.

SHERARDUCT—
THE *fortified* RIGID STEEL CONDUIT

SHERARDUCT is *fortified* against rust and corrosion by a zinc coating driven into the pores of all surfaces—inside, outside and *threads*. This coating is alloyed with the steel by the Sherardizing Process, and is an integral part of the tube itself.

SHERARDUCT is still further protected by the smooth "Shera-Solution" coating, baked on for added endurance against acids and other corrosive agents.

SHERARDUCT will not crack or split! Bending does not harm the fortified protection, because the coating is an integral part of the steel itself!

Specify SHERARDUCT—the *fortified*, full weight, threaded, rigid steel conduit. Sold through leading electrical wholesalers.

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Our Obligation to Society

THOSE WHO attended last week's AIEE general meeting heard one of the challenges of this era put into words by a leader peculiarly qualified to state it. The speaker was General Electric's president, Charles E. Wilson.

Addressing the Electrical Engineers on the subject, "The Professional Estate," Mr Wilson used as his principal theme quotations from Emerson, who said of the scholar, "It is not enough to turn forever inward and become nothing but a specialist. You are a part of society as a whole. You have duties and obligations as well as privileges and distinctions."

Mr. Wilson need not show his credentials in this regard. He spent some years in Washington during the last war, contributing materially to the war effort.

Mr Wilson also has served in many other sections of the public arena. He was a member of the President's Civil Rights Commission. He served on another, which studied the intricacies of Universal Military Training. He's not asking others to do what he shirks.

As a basis for justifying the engineer's activities as they relate to society, Mr Wilson made the following significant statement: "You underestimate your influence as professional men. It is my impression that people in general are more likely to trust and admire an engineer or a scientist than they are a lawyer or a teacher or a soldier or certainly a business man. . . . but by and large you enjoy a wholesome status in the public mind similar to that enjoyed by a policeman or a big brother in the mind of a small boy."

If this is not the impression which the public has of the engineer, then it is his business to create that impression. For such public favor is necessary if the engineer is to have the strength to carry out the obligations which Mr Wilson believes he has to society.

In defining the particular scope of these activities, we quote again from the context of Mr Wilson's address:

"Then what are the things that we ordinary citizens expect you to do that you have not done before? What is it that we now feel we have a right to expect from your professional estate? . . . In your preoccupation with your slide-rule you cannot safely leave to others—to the economists and politicians and lobbyists—the larger job of defending the way of life which was made possible by your own contributions. You have no right to turn away from such problems as education, taxation, government reorganization, national security, civil rights, labor and management, or atomic power development."

Mr Wilson did not point out the specific available channels through which the engineer may seek opportunities for shouldering his community responsibilities, for such outlets are known to all of us as being the church, school, civic association, chamber of commerce, club, and last but not least, the professional society.

Better Bosses

ONE OF THE BEST ways to safeguard the days ahead is to start now to grow a crop of better bosses.

Recently a big utility company has been trying to find out how employees feel about their jobs and the company. A confidential survey, conducted by an outside group, included the filling out of an extensive questionnaire by all 8,000 non-supervisory employees plus interviews with all supervisory employees and about 10% of the non-supervisory workers.

One of the most significant findings was the workers' opinions of their bosses. When workers were asked what they liked most about their company, supervisors were at the bottom of the list with 1% of the votes. In reply to "What do you like least about our company?" 8% pointed their fingers at their supervisors. This was despite a feeling which 56% had that they were satisfied with the company and a belief of 73% that supervisors think of their employees as human beings. Perhaps your company would fare better, but don't be too sure. Human relations are still the most complex mechanism in business to predict accurately. And, incidentally, this also means that surveys have to be analyzed with great care and common sense or they can be misleading in their implications.

Big industrial companies have been working on the problem of molding better bosses much longer than utilities. At a recent Southeastern Electric Exchange meeting, Ralph Lee of General Motors summed up the matter by pointing out that "It takes followers to make a leader." And followers are pretty exacting. According to Lee, General Motors finds that a follower (worker) wants a leader (boss) who

1. *Is not afraid* of his position, of his own boss, of a tough job, of the people who work for him, nor of honest mistakes, either theirs or his.
2. *Knows most of the answers*, but will admit it if he doesn't know, and get the answer.
3. *Can show the worker how to do a job* without showing him up.
4. *Is predictable*; that is, can be depended upon to be the same all the time.
5. *Suggests rather than orders.*
6. *Believes his work is important*, as are all those who are in it with him.
7. *Won't let a worker put anything over on him*, but is human enough to look the other way when the subordinate makes a fool of himself.
8. *Finds in his work* not only a means of earning a living, but also a reason for living.
9. *Recognizes the worker* as a person, regardless of the latter's experience, school, or station in life.
10. *Will listen to the worker* when he has something to say.

And Lee had a dozen more. But any boss who can face these squarely won't have any trouble with the others.

Based on these ten traits, what sort of report card would your own boss rate?

Or what's more to the point, how would your employees rate you?

Electric Home Heating

FEASIBILITY OF electric heating of homes in some areas, from the consumer's standpoint at least, depends on the degree of winter-tightness of the structure. Ultimately there will have to be some sort of index-rating of thermal leakage for the walls and windows. Above a certain assigned index the answer would presumably be interpreted as "yes" and below it "no."

At the present time such an index probably would have to be a composite of several different heat loss coefficients for various combinations of wall materials. Then a generous correction factor would be thrown in to compensate for the probable inaccuracy in estimating the heat leakage around windows and doors. The overall result leaves something to be desired in terms of precision.

Much of this "guesstimation" could be averted if there were available an instrument to detect the external areas of greatest heat loss and heat dissipation. Fortunately there is promise of the availability of such a device. The bolometer, which Shawinigan Water & Power Co has prompted the Canadian National Research Council to develop, was primarily intended for the detection of hot splices in transmission conductors. But A. S. Runciman of that company has asked CNRC whether it could not also be used for locating heat leaks.

The utility house-heating super(sales)man of the future may be unjustly caricatured in the comics as setting up something looking like a surveyor's transit to scrutinize the prospectively electrically heated home. But his serious recommendations can be the guide for the insulation specialist, the resident, and the utility company.

Facsimile for Operations

COMMUNICATION between utility operating headquarters, the district staffs, and interconnecting companies is pretty much by voice over carrier or leased circuits. But there are messages that involve diagrams, drawings, tabular data, even photographic reproductions that are cumbersome and time-consuming to read or describe. Furthermore there is chance for expensive errors, and the circuits are often tied up unduly, delaying other uses. The alternative of sending the difficult material by mail or messenger is not fast enough in many instances.

Just how numerous such communication problems are is probably still to be determined. If check discloses they are significant in number and importance, then something should be done to improve the handling of such messages.

Fortunately facsimile transmission is available for this purpose, and it has been given a limited tryout on utility systems. Reportedly it has been an effective way of having authentically reproduced information delivered promptly. Whether it will prove to be as indispensable as mobile radio is just a matter of economics. If they look into it, utilities probably will find facsimile transmission edging toward the justifiable side.

The Electrical Week

Electric utilities are asking for rate increases at a rapidly accelerating pace. However, many of the raises granted were in the form of fuel clauses. Now fuel costs are going down . . . Resolutions adopted last week by the National Rural Electric Cooperative Association clearly reflected the views of those who would expand the activities of REA and the co-ops . . . Wisconsin Electric Cooperative is setting up a nationwide field organization to secure contracts for ACSR from distribution co-ops . . . In Washington, the fight on the new labor law sponsored by the Administration is centering on the failure of the new law to provide what opponents consider a satisfactory way of preventing "national emergency" strikes, jurisdictional strikes, and secondary boycotts . . . And in British Columbia, where cold and drought have combined to curtail severely hydroelectric output, power supplies to industrial consumers have been cut 30%.

Of Connecticut's 22,241 farms, all but 172 have electric service. Of these 39 could be served, but their owners have declined services.

The Economic Cooperation Administration is sending a special mission to Europe to determine "the irreducible needs" of Marshall Plan countries for Western Hemisphere aluminum, lead, and other metals for which their own scrap supplies cannot be substituted.

The Public Utilities Advertising Association, which conducts the oldest advertising copy contest in the United States, has started another drive for members among business-managed utilities.

Nothing indicates just how hard utilities have been pressed to supply electricity as do these figures. In 1935, output per kilowatt of installed fuel capacity was 2,271 kwhr, of hydra capacity, 3,996 kwhr. In 1948, the estimated corresponding figures were 5,246 and 5,279 kwhr.

The American Gas Association in the present fiscal year will spend $800,000 for national advertising, $312,000 for promotional projects, and $710,000 for research.

Pacific Gas & Electric Co has more power plants than any other utility in the United States. It had 75 at the end of 1947.

According to the Federal Power Commission, power capacity in the United States increased 8.14% in 1948, from 52,211,488 kw to 56,463,509 kw.

South Carolina Public Service Authority (Santee-Cooper) paid $101,223 in lieu of taxes in fiscal 1948. The law firm of Jefferies & McLeod received $77,000 for legal services, and $10,500 is still due the firm. The senior member of the law firm is State Senator R. M. Jefferies, general manager of Santee-Cooper.

In Sweden 90% of all farms and country homes are electrified.

Right now all suppliers of electric energy in the United States are planning to add some 28.5 million kw of capacity. But there will be no good times in the industry until producers can start talking of retiring several million kilowatts of high-cost capacity each year.

New England leaders who have been searching their souls for years as to the future of their region got a pat answer from Interior Secretary Krug recently. Krug said industry wouldn't desert New England if it had low-cost power.

Publicity Department—Of all the stories concerning the meeting of the American Institute of Electrical Engineers held last week at New York, the two that got the best play in the newspapers were those on an electric eel's escaping momentarily and on a light outage during one of the technical sessions.

Reynolds Metals describes the 715,000,000-lb ACSR conductor contract it signed recently with the Wisconsin Electric Cooperative as the biggest single aluminum order in history except for that which the U. S. government placed with the Aluminum Co of Canada during the last war.

Notes From The News

For the Pennsylvania Electric Co 1948 was a safety year. The accident rate was 5.62 per million man hours . . . Central New York Power Corp must get a Federal Power Commission license if it wants to build a dam and storage reservoir on the Raquette River . . . Some Virginians have been aroused by the Buggs Island project. Relocation of roads would force them to buy not in Clarksville, Va., where they have shopped for years but in North Carolina . . . Consolidated Edison Co of New York has hired New York Police Commissioner Arthur W. Wallander at a salary reported as over $20,000 a year. Wallander will supervise traffic problems for the utility, which furnishes

NEW MERCURY VAPOR LIGHT installation, a part of Philadelphia's Vine Street Improvement Project, led to this celebration. Speaking is George E. Whitwell, vice-president of Philadelphia Electric Co. Others at the table, left to right, are Samuel S. Baxter, assistant chief engineer of the City's Bureau of Engineering; Mayor Bernard Samuel; and Director Thomas Buckley of the Department of Public Works. The 56 lights have been installed on the Vine Street approach to the Delaware River Bridge. The system is to be extended to other areas

gas and steam as well as electricity in the congested New York area . . . Long Island Lighting Co has granted its IBEW employees a 5% wage increase retroactive to Jan 1 . . . Westinghouse Electric Corp has purchased a former airport, 146 acres in area, on the outskirts of Pittsburgh as the location for its new Atomic Power Division . . . Wisconsin Public Service Corp has won an FPC license for its existing Hat Rapids project on the Wisconsin River.

The City of Tacoma will sue the State of Washington for $5,000,000 if the legislature passes the Cowlitz River fish sanctuary measure, which would block the city's power project on the river . . . The United Kingdom, Netherlands, and Belgium have been cleared of charges that aluminum and lead received from Marshall Plan shipments have been resold in this country . . . Because the use of oil for fuel will reduce the cost of equipment for its new municipal power plant by $116,000, Tallahassee, Fla., has abandoned plans for a coal-burning plant . . . The British government will take over all gas utilities on May 1 . . . Florida Power & Light Co is suing the federal government for $43,968. The charge is that a Coast Guard cutter rammed an intake-screen chamber at its Miami Beach steam plant and put a low-pressure unit out of operation for a year . . . The Tennessee Rural Electric Cooperative Association, made up of the 21 co-ops operating in the state, will establish offices in Murfreesboro.

Old and inefficient electrical appliances are said to be wasting a lot of Britain's inadequate power supplies . . . Kentucky Utilities Co has severed all connections with Middle West Corp . . . At Lehigh University, where he received an honorary degree of doctor of laws, AEC Chairman David E. Lilienthal came out in favor of dissemination of facts and public discussion about atomic energy . . . Alaska River control systems could produce 50 billion kwhr of electric energy annually, according to Joseph M. Morgan of the Bureau of Reclamation . . . Stream flow at Bonneville Dam, which was reduced during the cold wave, is slowly returning to normal . . . New York State Electric & Gas Corp has engaged William G. Christy, a smoke abatement expert, as a technical adviser . . . Puget Sound Power & Light Co has appealed the award of a decree of public use and necessity to Snohomish County PUD No. 1 in an action to acquire company property in Snohomish and Island Counties, Wash.

Construction:

San Diego Gas & Electric Co's $15,000,000 expansion program for 1949 includes $2,750,000 for a third 50,000-kw generating unit at Silver Gate Plant . . . The British Columbia Power Commission has suspended work on its hydroelectric plant at Silver Creek and will buy power from B. C. Electric Railway Co to supplement supply in the Hope area . . . Aluminum Co of America will build a 30-story aluminum-faced office building in Pittsburgh . . . After building 3,415 miles of rural lines in 1948 Appalachian Electric Power Co will add another 3,287 miles in 1949 . . . Jasper, Ind., has put a new 5,000-kw steam plant into operation.

Financial:

If the Federal Power Commission approves the price and coupon rate, Duke Power Co can issue $40,000,000 in first and refunding mortgage bonds, due in 1978 . . . Pennsylvania Water & Power Co, which is fighting a rate reduction ordered by the FPC, has cut its quarterly dividend on common from $1 to 50¢ . . . New Brunswick Power Co, whose properties have been expropriated by the government's N. B. Electric Power Commission, has announced that it will redeem its second preferred stock at $100 a share.

Electric Rate Trend Turns Upward

Rising Operating Costs and Need for More Revenue to Attract Capital Needed for Expansion Programs Force Companies to Seek Rate Increases

REQUESTS FOR electric utility rate increases were made at a sharply increasing pace during the last quarter of 1948 and so far in 1949, an ELECTRICAL WORLD survey showed this week.

Whereas the box score for the 21 months ended Sept 30 showed 66 rate boost requests by 64 companies, the record for the 18 weeks since then shows about 49 more requested increases. That means that about two-thirds as many systems have asked for relief in about one-fifth the time.

Over 115 Ask Relief

All in all, in the last 25 months more than 115 requests have been made by about 95 electric companies. During the same period more than 150 co-operatives and municipal systems have upped rates.

One thing favors the rate-payers, particularly those on industrial and commercial schedules. That is the fact that many of the company rate increases came in the form of fuel clauses, under which rates vary up or down with the cost of coal or oil. There are more of these escalator clauses than ever on residential rates, too, but the device still is confined principally to non-domestic rates.

Coal Prices Down

With coal prices trending downward since the last part of 1948's third quarter (EW, Feb 5, Page 5), the users who've borne the heaviest load of power rate boosts so far look as if they'll be the first to get relief.

Lower coal prices also might slow down the incidence of new rate increase requests. The driving factors behind the rate boost trend remain the same—rising operating costs, of which fuel is a major portion, and the need for new capital for expansion. The upped operating costs remain the major cause of rate increases, industry experts say. They ascribe the last-quarter splurge in rate requests, at a time when coal prices were sagging a little, to the fact that many systems are now feeling the full impact of last year's coal and other cost increases.

Although electric utilities aren't a bit happy about raising the price of their service—thus having to forsake a steady downward rate trend of a quarter of a century—there's one bright thing in the picture. They're getting the rate relief they are seeking, and they're getting it faster than they would have believed it possible for utility regulatory commissions to move. Just as a guess, one expert figured that the average interval between a request for an increase and its effective date is from two to three months.

One reason for this is the fact that in many cases the intricate matter of rate base determination hasn't been involved. It's been a much simpler case, generally, of needing relief for zooming costs or bait for new money. After years during which rate actions have been deeply involved in rate base determination and lengthy litigation, today's prompt action is surprising to some. Probably another factor is the widespread recognition by state commissions of the industry's need for capital if it shall continue to render good service. None of the pending requests dates back beyond September. One sought then and another asked in October remain undecided. All others were sought in November or later.

Industry sources aren't yet ready to predict flatly whether the average revenue per residential kilowatt-hour will continue the steady downward trend it has shown since 1906. (It bobbed up in 1918 and 1925, held steady in 1923-24, but has dropped every other year.) Already the rate curve, which had been down for 25 years, has turned up. Whether the average domestic revenue curve follows it this year depends on the sales—of appliances and energy—in 1949. If consumption goes up sufficiently, the average revenue per residential kwhr will drop again. If consumption doesn't bounce up, the average revenue will, under the impact of the rate increases already granted.

This phenomenon, related to the "decreasing-cost-for-increasing-use" characteristic of electrical rates, already has shown up in industrial kwhr revenues. They have gone up 13% per kwhr since the all-time low point of March, 1944. A substantial part of that increase has come since last August, under the impact of all the industrial fuel clauses which have been invoked or instituted in recent months. But of that 13% increase in average revenue per industrial kwhr, only 8% is attributable to rates. The remainder is due to the lower per customer use by industrial customers.

Latest drop in the average revenue per residential kwhr came last year, from 1947's 3.09¢ to 1948's 3.01, most of it in the first half. This drop was below that of 1945-46, 0.19¢, and that of 1946-47, 0.13¢, indicating a pronounced flattening of the downward trend of average revenue. Already, for sales to all ultimate users, this trend has gone up—from 1.77¢ in 1947 to 1.79¢ in 1948. But it's still well below 1939's 2.16¢.

As far as can be determined, only one rate increase request has been turned down—that a plea by Kentucky's Community Public Service Co for a residential fuel clause to yield an estimated $42,000 yearly. In refusing it, the Kentucky Public Service Commission said the company remained free to submit evidence of any need for higher rates.

Another happy aspect is that, in general, those companies that seek rate boosts get substantially what they need. There have been a few cases where big systems got rate boosts appreciably short of the requested relief. But these, according to the experts, are explainable by local circumstances independent of the general picture.

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Co-op Formed in Texas

Big Bend Electric Cooperative, Inc, Marfa, Tex., has been incorporated by George Jones, William Allison, and J. W. Lawhon, and its charter has been approved by Secretary of State Paul H. Brown. It is a rural electric cooperative, without capital stock.

Matchless Service!

Henry Braithwaite combines a job for Columbus and Southern Ohio Electric Co with duties as mayor of West Jefferson. Everyone agrees that he combines them effectively.

When an explosion started a bowling alley fire, the flames soon destroyed telephone communications. So Braithwaite used the utility's radio system to ask Columbus for help. Damage was estimated at $100,000, but firemen said the whole village might have been destroyed if aid hadn't been summoned promptly.

Theories of Co-op Expansionists Reflected by NRECA Resolutions

By Richard N. Larkin

RURAL ELECTRIC systems would get vast new opportunity to penetrate urban power markets under a resolution adopted last week by the National Rural Electric Cooperative Association, in convention at New York.

A declaration to this effect headed a list of 20 resolutions adopted by the 3,700 delegates to the largest meeting in NRECA's history. Other outstanding resolutions:

REA Telephones Sought

1. That Congress set REA up in the rural telephone business.
2. That the repayment term for REA loans be extended to 50 years.
3. That REA liberalize its traditional generating-loan policy and make more such loans.
4. That Congress appropriate funds for construction of all authorized hydroelectric projects and for study of additional power developments.
5. That Congress authorize $450,000,000 in REA loan funds for the coming fiscal year and kill the 30-day notice period on generation and transmission loans by REA.

In any drive for opportunity to penetrate deeper into urban areas REA would be hampered by a provision confining its loans to borrowers serving areas that do not lie within the boundaries of municipalities whose population is above 1,500.

Asks Broader Authority

To obviate this difficulty, NRECA's resolution asked that the REA Act be amended so as to broaden the administrator's lending authority. It sought for the administrator authority to make acquisition loans:

1. Which do not impair existing loans.
2. Where the borrower will benefit, financially or in service.
3. Where service to acquired systems will not suffer.
4. Where acquired facilities may be integrated effectively with existing systems.
5. Where the sale is voluntary.

In addition to removing the 1,500 population limit, the NRECA proposal would, for the first time, specifically legalize acquisition loans by REA. For years REA has construed the statute to mean that it may make such loans and for years it has made them. Recently little if any challenge of this interpretation has been heard. When the interpretation was challenged repeatedly some years ago, REA won numerous "votes of confidence" directly on this issue. But there never has been specific statutory authority for acquisition loans.

Speculatively, at least, several reasons exist why NRECA would want REA to have such new authority as its resolution proposes. Most obvious are that it would remove the 1,500 population limit on co-op activities and would let REA make even bigger acquisition loans than it has made without fear of new challenge.

On the record of REA's thinking, it seems likely that another justification for such jurisdiction would be that this authority would let REA integrate small rural systems into larger urban operations. The enlarged systems then might be able to extend lines into unremunerative territory. Combining urban load concentrations with skimpy rural business has long been cited by REA leaders as a "must" if area coverage shall be attained everywhere.

Still another likely motivation for this resolution lies in NRECA Manager Ellis' declaration that co-ops might well support municipalization drives against electric utilities that attempt to buy out cooperatives. Such support for municipalization was coupled with the idea that REA might lend directly to municipalities where such loans—for generation or transmission—would permit mutual ties between co-op and municipal systems.

NRECA's resolutions this year didn't deal specifically with Ellis' thoughts on stronger relations between municipals and co-ops. But the resolution seeking broader acquisition loan authority for REA ties logically into the thinking behind Ellis' program for stronger municipal-co-op relations. Indeed, outright acquisition of municipal properties and loads seems more directly of benefit to the REA expansionists than would be co-op-municipal interconnection and mutually owned generation.

One NRECA resolution which may meet with less than enthusiastic reception is that calling for a liberalized REA policy on generation loans. Through a good deal of urging by the expansionists that more such loans be granted, Administrator Claude R. Wickard has held firmly to the same policy that was enunciated before he became administrator. The policy rests on two points:

1. Generation loans shall solve power shortages.
2. They shall save money over wholesale charges.

While REA's loans for generation have increased much more than the electric utility industry can believe is wise, they haven't begun to satisfy the expansionists. Numerous bits of evidence are at hand that Wickard has been resisting attempts to push the agency deeper and deeper into generation lending. It was apparent at last week's convention, however, that the expansionists haven't stopped pushing and that they don't expect to lose their fight for more co-op generation.

Yet Wickard said flatly in a prepared speech that:

"Your representatives in Congress are the only people who can make a change in the policy. Until there is a change, I am going to follow conscientiously our present policy in regard to these loans."

Round 5—Hoover (?) Dam

Another round is coming up in the name-swapping battle of Boulder vs Hoover Dam.

Both names are official. Arizona never has recognized Hoover Dam because a state law prohibits changing names of public places. Nevada cooperated with the 80th Congress and changed Boulder to Hoover—on its end of the dam, at least.

Originally the dam was to have been built in Boulder Canyon. Later the site was moved 12 miles downstream to Black Canyon, but the name Boulder stuck until Hoover's Secretary of Interior—the project was authorized and started during Hoover's term—switched it to Hoover. Along came the Democrats, and Harold Ickes changed the name back to Boulder. When the GOP returned to power it imposed the name Hoover Dam by law.

Now residents of the area are wondering what the new Democratic Congress will do.

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Wage Increase Granted

The Sacramento, Calif., Municipal Utility District has authorized a 9¢-an-hour wage increase for some 500 employes, effective Feb 1. The directors explained the increase was voted to meet pay scales of the Pacific Gas & Electric Co, which recently granted a 9¢ cost of living increase. The pay hike represents a rise of 4½% or about $100,000 a year.

FIRM OR NOT it's another contract between a cooperative and Wisconsin Electric Cooperative for ACSR. Setting is WEC's office at Hotel Commodore during NRECA convention

WEC Organizing Nationwide Field Staff to Sell Cooperatives ACSR

THE WISCONSIN Electric Cooperative was finishing organization of a nationwide field staff this week in anticipation of vigorous "house to house" selling among rural electric cooperatives. Its minimum goal was firm contracts for 199,800,000 lb of ACSR conductor to be delivered between Feb 1, 1950, and Feb 1, 1953.

WEC was unable to give any figure as to firm contracts so far, pointing out that those which had been signed had been forwarded to the Rural Electrification Administration in Washington. Contracts are not firm until okayed by REA. None had been processed there and returned at mid-week, WEC officials told ELECTRICAL WORLD.

Two WEC officials declared, however, that they are "definitely encouraged" by the reaction of REA-financed cooperatives to the WEC proposal for the purchase of as much as 715,000,000 lb of ACSR from the Reynolds Metals Co. They added that the acceptance which greeted this program for stimulating conductor deliveries to cooperatives at the NRECA convention in New York last week was beyond expectations.

Many cooperative officials, these spokesmen declared, arrived at New York without authorization to sign firm contracts. Also, no material contracts signed by co-ops are firm unless approved by a majority of co-op directors. Both these factors mitigated against the signing of more firm contracts in New York last week, the WEC spokesmen said.

Another retarding factor was the fact that many co-op representatives arrived in New York with an indistinct knowledge of the advance payment provision of the conductor deal. Also, they thought of their own requirements in "round numbers" rather than in precise figures. Faced with the requirement of paying 4¢ as advance payment for every pound ordered for delivery by Feb 1, 1953, numerous co-op purchasers backed off long enough to figure their requirements more precisely, a WEC official said.

To push the sales drive, WEC has set up regional representatives for eight of the ten regions into which co-ops are organized. Assignments in the two remaining regions are expected soon. Lawrence Potamkin, WEC counsel in Washington, D. C., will handle the conductor program, at least temporarily, in Region I. No assignments have yet been made in Regions II and III. Harry L. McAllister, of St. Clairsville, Ohio, will take charge of the program in Region IV; Kenneth Coyle, of WEC's staff, will handle Region V; Neil Woolever, WEC, Region VI; A. B. Davis, Hutchinson, Kans., Region VII; Ansel Moore, Region VIII; Carl Moore, Region IX; and O. B. Bryan, Region X. McAllister, Davis, Bryan, Ansel Moore, and Carl Moore are co-op officials in Ohio, Kansas, Missouri, Washington, and Texas, respectively. They will take leaves of absence to complete the WEC sales job. If it seems wise, each may have several assistants, who may remain on the WEC payroll after the campaign ends. Harvey Schermerhorn, WEC's assistant manager, will head the national sales program.

The drive behind WEC's organizational efforts was the May 14 deadline for advance payments on the conductor.

Under the Reynolds-WEC contract, advance payments of $1,000,000 must reach Reynolds by March 14; $1,500,000 by April 14, and $3,500,000 by May 14 for the contract to become final. These advances are cumulative. The $6,000,000 they represent will be used by Reynolds for the financing of the expansion it must make to fulfill the contracts.

To Finance Expansion

WEC itself will participate in the advance payments—the aim being to finance its expansion from a four-state to a national distributor to co-ops of ACSR conductor. On every pound of ACSR ordered for delivery between next Feb 1 and Feb 1, 1954, a 4¢ advance payment is required. Of this, 3¢ goes to Reynolds, 1¢ to WEC. Reynolds will repay advances with 2% interest at the time of shipment. WEC will deduct selling expenses from the advances it gets and return the remainder on a patronage basis when its operation is established.

While WEC officials showed enthusiasm for the prospects of success in their sales program, antipathy remained apparent in other quarters. In Washington, Kenneth McKellar, head of the Senate Appropriations Committee, which must pass on REA's loan authorizations this spring, wrote what he described as "a very strong letter" against the deal to Agriculture Secretary Charles F. Brannan. McKellar's letter, not released immediately, was understood to follow closely the line taken by Pres H. D. Seaton, of the Southern Electrical Corp, Chattanooga, in a letter to NRECA.

Says Capacity Available

Seaton complained against NRECA's participation in a deal whereunder new capacity for fabricating ACSR conductor would be set up while vast amounts of that capacity remain available under today's aluminum ingot shortage.

In a statement at last week's NRECA convention, SEC's sales manager, H. H. Bullen, declared that he had received no answer to his question of why co-ops should be asked to advance $6,000,000—all of which might come from REA as loan funds—while ample capacity to do the job remains available. Bullen added:

"Southern Electrical offered an alternate proposal, that if Reynolds would produce ingot . . . and offer it to independent fabricators at a price even 10% above the prevailing market price, Southern Electrical, for one, would gladly have such metal converted into

EDISON MEDAL PRESENTATION at American Institute of Electrical Engineers general meeting involved Everett S. Lee, left, AIEE president, who presented medal to Morris E. Leeds, chairman of the board, Leeds & Northrup Co. I. Melville Stein, vice-president, Leeds & Northrup, described the career of the medalist. Archer E. Knowlton, senior associate editor of *"Electrical World"*, gave the history of the medal.

rods and fabricate it into conductor and sell it at the same figures quoted in the WEC-Reynolds contract without requiring one penny advance deposit from the co-ops, nor the commitment of a single future order. No discussion or action followed that proposal."

Cable producers were concerned over the prospects of additional competition, which would enter the field with the market largely sewed up and with the benefits of indirect federal financing at 2% interest. Distributors and others affiliated with the trade also were on edge at the implications.

One WEC official, asked whether WEC might not become "a cooperative version of Graybar, GE, or Westinghouse Supply," conceded that exactly that might happen. His lack of concern over the prospect seemed to strengthen the belief that WEC had no intention of confining its nation-wide distribution activities to the ACSR conductor it will get from Reynolds under the existing contract.

Depending on who was doing the talking, the main complaints against the Reynolds-WEC deal were these:

1. No new ACSR capacity should be set up while so much is available now.

2. Federal financing, even though indirect, should not be made available to set up new and unneeded capacity in competition with existing facilities.

Supporters of the Reynolds-WEC contract argued that those who opposed it were attempting to condemn Reynolds—which has no ACSR facilities at present—to two situations, each of which would work against Reynolds:

1. Continuation as a less-than-fully-integrated aluminum producer.

2. Continuation in the low-profit-margin end of the aluminum business.

Unless it can produce ACSR, this argument ran, Reynolds can only sell ingot to wire fabricators at a relatively low profit margin on the ingot business. If it can make cable of its own, Reynolds can get into the more profitable end of the aluminum cable business.

Whatever the merits of the latter argument, experienced cable people spoke derisively of the off-the-cuff profit figures—"8 or 9¢ per lb on cable"—which were cited on Reynolds' behalf.

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5 Utilities in Competition for 1948 Coffin Award

Five electric utilities have been asked to prepare presentations on which the 1948 Coffin Award will be made. The companies are Cincinnati Gas & Electric Co, Detroit Edison Co, Philadelphia Electric Co, Southern California Edison Co, and Union Electric Co of Missouri.

From these five, the Charles A. Coffin Award Committee will select the winner of the gold medal. The employees benefit fund of the winning company will receive $1,000.

The award was established 27 years ago by General Electric Co to honor each year the electric company making "the greatest advancement in its operation and physical plant, thereby making a distinguished contribution to the development of electric light and power for the convenience of the public and the benefit of the industry."

Presentation is made at the annual convention of the Edison Electric Institute, which sponsors the competition.

B.C. Rationing Plan Cuts Industrial Power by 30%

The British Columbia Electric Railway Co has cut industrial power supplies in the province by 30% under a Public Utilities Commission-approved rationing scheme.

The company's reliance on watershed-fed reservoirs as a winter source of supply for its main hydroelectric plants has threatened British Columbia's industrial lower mainland with near paralysis in its third power shortage in 20 years, brought on by abnormally cold, dry weather conditions.

With the power cut, company officials issued a warning that water reserves would last only 10 days unless power consumption was slashed by a third, and until March 2 if the cut was made and no adequate rainfall occurred.

Bad Weather Continues

Since then the situation has continued to deteriorate, with freezing, rainless conditions persisting into the second week in February.

The 30% industrial cut was the second conservation order within two weeks. The first, effective Jan 20, banned commercial illuminated signs and outside and show window lights and ordered a 50% cut of all inside lighting, commercial and residential.

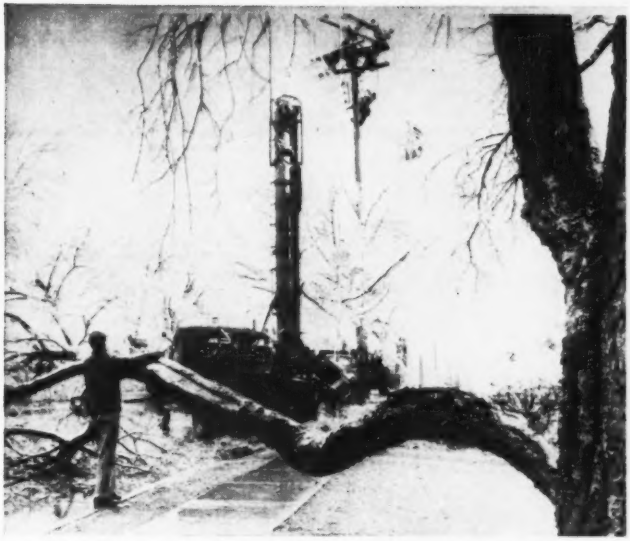
The initial reductions brought savings up to 20-22% after appeals for voluntary reductions had brought only 10%. In the first three days of operation the second order boosted cuts to 28%, with the 2% a day increase in savings expected to grow as the full effect of the program was felt.

The shortage was caused by a record freeze-up, which started Dec 14, and the driest January on record, bringing a drop of more than 1,500,000 kwhr daily in water reserves supplying major hydro installations in the Fraser Valley.

Rain 90% below Average

Official precipitation for January, including rain and snow, was 0.83 inches, compared to a 47-year average of 8.18 inches. December snow was held in the watersheds by freezing conditions, cutting runoffs. Hydro units at Stave Falls, Ruskin, and Alouette, fed by Stave Lake, and Bunzten, fed by Lake Coquitlam, totaling 234,000 hp capacity, were the units involved. The average demand has been for 3-4,000,000 kwhr daily.

Bridge River, the first unit of which went into operation last fall, is supplying well over its rated 62,000 hp, generating up to 70,000 daily, and is unaffected since it is fed by the free-flowing Bridge River.



IN ICY SETTING, unusual for the Dallas area of Texas, a line crew of the Dallas Power & Light Co uses a post hole digger in replacing a pole broken by the ice and wind

Fight on Labor Act Centers on Use of Injunction, Secondary Boycotts

THE BIG Congressional debate on new labor legislation to replace the Taft-Hartley Law will center on two major objections to the Administration's bill:

1. Its failure to retain the injunction, or some other "club," for coping with national emergency strikes affecting public health and welfare.

2. Its failure to provide a means for preventing jurisdictional strikes and secondary boycotts.

It was evident as the Senate Labor Committee rushed through its hearings this week that there was considerable sentiment among Republicans and Democrats for continuing the President's power to enjoin national emergency strikes or to stop them by government seizure.

The Truman bill dropped the Taft-Hartley 80-day injunction. It substituted a simple 30-day cooling-off period while an emergency board prepares recommendations for settling the dispute.

Administration spokesmen differ as to what powers this provision would leave the government to deal with an emergency like a coal strike. Secretary of Labor Maurice J. Tobin told the Senate committee the government would have the force of public opinion behind it.

Attorney General Tom Clark, in a memorandum to the committee, held that the President had "inherent power" under the Constitution to seek court action to protect the country in an emergency. Truman, at his press conference, agreed with Clark, but said he had no objection to an injunction provision, although he did not think it necessary.

William H. Davis, former chairman of the National War Labor Board, urged before the Senate committee that the President be given the power to seize the facility in any emergency strikes affecting utilities, food, fuel, and transportation and in political general strikes.

The Truman bill would forbid the use of injunction for any purpose in a labor dispute. It would make jurisdictional disputes and secondary boycotts aimed at furthering such disputes unfair labor practices. They would be decided by the National Labor Relations Board or its arbitrator, but there would be no compulsion against a stoppage of work pending a decision.

Recognizing the need for a "club behind the door" to force peaceful settlements of inter-union differences, some administration labor advisers are discussing the advisability of permitting NLRB in these cases to issue interim decisions that would be enforceable in the courts pending a final ruling.

Another controversial issue is the plan to lift the Taft-Hartley ban on the closed shop. The proposed bill would also give the federal policy on this question precedence over some 15 state laws that either ban or regulate the closed shop. In other words, for employers whose operations affect interstate commerce—most utilities—the state laws against the closed shop would have no effect.

Presumably there would be no change from Taft-Hartley on application of state laws regulating disputes in public utilities. Employers in interstate commerce are not subject to state law where it conflicts with a federal law such as Taft-Hartley. Where there is no conflict, the state law is applicable (EW, Sept 13, 1947, Page 100).

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New Transportation Load Just a Dream to Utilities

A potential load of the size and type of which utilities have been dreaming may be on its way. The load builder is a conveyor belt—not the short lengths used in factories but one 130 miles long with a demand of 250,000 kw when loaded. And the plan is to run the conveyor at least 20 hours a day, 300 days a year. What is more, success of the project could lead to other similar installations.

The conveyor, which if built will run from Lorain, Ohio, to a point on the Ohio River near East Liverpool, will carry coal north and iron ore south. Proposer of the idea is the Akron, Canton & Youngstown Railroad Co.

But the one big stumbling block is a legal one. The railroad does not serve the entire area where the conveyor is to be built. It will have to acquire most of the land. There is no law in Ohio giving a conveyor-belt company the same right that a railroad has to condemn land. AC&Y wants this right before it will start the project. This means going to the Ohio legislature. A fight is expected from companies controlling forms of competing transportation.

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Florida Franchise OK'ed

Freeholders of Melbourne, Fla., have voted favorably on a 30-year municipal franchise for Florida Power & Light Co. The company has been serving the city since it took over the Brevard power plant in 1927.

Interior Sketches Vision of Expanded Future Role

The Interior Department painted a picture of itself for the new Congress this week and last. It was a before-and-after portrait, showing the department as it is now and as it hopes to be. To political observers it appeared that Interior is looking for the job of inventorying, developing, and watch-dogging all the country's natural resources.

Sen Joseph C. O'Mahoney, Wyoming Democrat and staunch friend of the department, called for the show. It started Jan 31, with hearings before the Senate Interior and Insular Affairs Committee, of which O'Mahoney is chairman. For a week Interior's top officers, led by Secretary Krug, described the department's programs.

Krug asserted Interior's broad responsibilities included "protection and development" of national resources. We aren't doing so well in conserving them, he said.

Krug was specific on power. We waste more hydroelectric energy than we produce, he declared because we have not built the facilities to develop it. The country will need 80,000,000 kw of additional generating capacity by 1970, he estimated. Of this, at least 30,000,000 kw should be in federal hydro plants, and we need continued research in long-distance power transmission.

Most of Krug's bureau chiefs told the committee they needed more funds to carry out their programs. Some, like Reclamation Commissioner Straus, requested new legislation. Straus said his agency should have clear authority to build all "necessary" power facilities in connection with hydro projects—including transmission lines and steam plants.

Plans have been made to protect Reclamation dams and power plants in event of a national emergency, Straus revealed. He gave no details, but Sen Guy Cordon, Oregon Republican, expressed doubt that even an atomic bomb would do much damage to a concrete dam. A concrete ship in the center of those blasted in the Bikini test survived without serious damage, Cordon revealed.

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Kauffman Gets PSC Post

H. Clay Kauffman, Lancaster, Ky., attorney and farmer, has been appointed to the Public Service Commission. Kauffman's selection was deplored by J. E. Stanford, executive secretary of the Kentucky Farm Bureau Federation, on the ground that he "is generally considered an enemy of public power"

SEC RULINGS

General Public Utilities Corp has been authorized to borrow $1,500,000 from four commercial banks on its one-year unsecured 2¼% notes. Proceeds of the notes will be used to prepay $1,200,000 of 1½% notes which matured Jan 14, to prepay $250,000 of 1½% notes maturing Feb 20, 1949, and to the extent of $50,000 to provide part of the funds necessary to pay on April 3, 1949, 25% of the principal amount of 1¼% notes due April 3, 1949, in the amount of $748,800. The commission authorized the renewal of the $561,600 balance of such latter notes. (Release No. 8784).

Mississippi Power & Light Co has been authorized to issue and sell, at competitive bidding, $7,500,000 of 30-year first mortgage bonds. Proceeds are to be used for construction additions and betterments in a construction program calling for expenditures through 1950 of $25,000,000 for electric and $2,560,000 for gas facilities. (Release No. 8775).

Union Light, Heat & Power Co, Cincinnati, has received permission to sell at competitive bidding $5,000,000 of first mortgage bonds and 20,000 shares of common stock. Union Light said the interest rate on the bonds, as well as the offering price and underwriting terms, would be supplied by amendment. The stock is to be offered for subscription at $100 a share. Common stockholders of the company will get the first opportunity to subscribe for the shares at the rate of 4/94ths of a new share for each 1/94th of a share held. As the owner of 98.42% of the outstanding stock of Union Light, Cincinnati Gas & Electric Co proposes to exercise its right to purchase its pro rata portion, 19,683 38/94 shares, of the new stock in payment, Cincinnati will surrender a like amount of 6% notes of Union Light now held in the amount of $2,067,238. Union Light will pay the balance of such notes from its treasury funds. (Release No. 8789).

Southern Indiana Gas & Electric Co has received clearance on the negotiated underwriting of 685,000 shares of its common stock. Of these shares, 600,000 constitute the present holdings of Commonwealth & Southern Corp, and the 85,000 represent additional shares of the issuer to be acquired by Commonwealth for immediate resale to the underwriters. Proceeds to Commonwealth of the 600,000 shares will be applied to the retirement of indebtedness, while Southern Indiana will use the proceeds from its sale of the 85,000 shares to assist it in the financing of its current construction program. (Release No. 8790).

Middle West Corp, Chicago, has been authorized to proceed with plans for distribution of 1,655,000 shares of $10 par Kentucky Utilities Co common stock to its common stockholders. Distribution was to have been made on Jan 27 to stockholders of Dec 28 at the rate of one share of Kentucky common for each two shares of Middle West common. (Release No. 8788).

MEETINGS

Edison Electric Institute—Electrical Equipment Committee, New Jefferson Hotel, St. Louis; February 14-15; Annual Sales Conference, Edgewater Beach Hotel, Chicago, April 5-7; Engineering Committee, Edgewater Beach Hotel, Chicago, May 2-4; Annual Meeting, Traymore Hotel, Atlantic City, May 31-June 2.

Pennsylvania Electric Association—Systems Operation Committee, Fort Stanwix Hotel, Johnstown, Pa., February 17-18; Relay Subcommittee, Roosevelt Hotel, Pittsburgh, Pa., February 17-18; Transmission & Distribution Committee, Benjamin Franklin Hotel, Philadelphia, February 24-25; spring meeting, meter committee, Abraham Lincoln Hotel, Reading, May 19-20.

National Association of Home Builders—Convention and Exposition, Stevens Hotel, Chicago, February 20-24.

National Adequate Wiring Bureau—Annual Conference, Stevens Hotel, Chicago, February 24-25.

Missouri Valley Electric Association—Sales & Rural Committee, February 25; Accounting Committee, March 7; Engineering Conference, April 6-8; Rural Roundtable, May 4, Sales & Rural Conference, May 5-6; Accounting Conference, May 12-13; Annual Meeting, May 17. All meetings at the Hotel President, Kansas City, Mo.

American Society for Testing Materials—Spring Meeting and Committee Week, Edgewater Beach Hotel, Chicago, February 28-March 4; Annual Meeting, Chalfonte-Haddon Hall Hotel, Atlantic City, June 27-July 1.

Exposition of Electrical Progress—Municipal Auditorium, Kansas City, Mo., March 2-6.

Institute of Radio Engineers—National Convention and Exposition, Hotel Commodore and Grand Central Palace, New York, March 7-10.

National Electrical Manufacturers Association—Winter Convention, Edgewater Beach Hotel, Chicago, March 13-18.

Conference for Protective Relay Engineers—Texas A & M College, College Station, Tex., March 14-16.

Oklahoma Utilities Association—Annual Convention, Hotel Tulsa, Tulsa, March 17-18.

Southeastern Electric Exchange—Engineering & Operation Section, General Oglethorpe Hotel, Savannah, Ga., March 24-25; Annual Conference, Boca-Raton Club, Boca Raton, Fla., April 13-15.

International Lighting Exposition and Conference—Stevens Hotel, Chicago, March 29—April 1.

American Institute of Electrical Engineers—Conference on the Industrial Application of Electron Tubes, Statler Hotel, Buffalo, N. Y., April 11-12; South West District, Baker Hotel, Dallas, Texas, April 19-21.

National Association of Corrosion Engineers—Annual Conference and Exhibition, Netherland Plaza Hotel, Cincinnati, April 11-14.

Western Metal Congress & Exposition—Shrine Convention Hall, Los Angeles, April 11-15.

Midwest Power Conference—Sherman Hotel, Chicago, April 18-20.

National Electrical Wholesalers Association—Annual Convention, Netherland Plaza Hotel, Cincinnati, Ohio, May 1-6.

American Society of Mechanical Engineers—Spring meeting, Hotel Mohican, New London, Conn., May 2-4.

Electrochemical Society—Spring meeting, Benjamin Franklin Hotel, Philadelphia, Pa., May 4-7.

Instrument Society of America—Spring meeting, Royal York Hotel, Toronto, Canada, May 12-13.

National Fire Protection Association—Annual meeting, Fairmont Hotel, San Francisco, Calif., May 16-19.

Wallgren Is Nominated for NSRB Chairmanship

Mon C. Wallgren, former Democratic governor of Washington, has been nominated as chairman of the National Security Resources Board to succeed Arthur M. Hill.

Industry people accustomed to working closely with NSRB on the agency's advisory committees were something less than pleased with the appointment, which was announced by the White House Feb 3. Wallgren, they pointed out, has no industry experience. His nomination, which must be approved by the Senate, might presage less sympathetic cooperation between NSRB and business, they feared. There is little doubt that the nomination will be approved by the Senate, of which Wallgren was a member before he resigned to become Washington's chief executive.

President Truman, however, held that Wallgren was particularly fitted for the NSRB post as a result of his Senate experience. The Washingtonian was a member of the War Investigating Committee, of which Mr Truman was the chairman. The committee probed the government's war supply contracts, a task the President impliedly compared with NSRB's present job of drafting war mobilization plans.

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Supplemental Spending Bill Hits Committee Snag

President Truman's request for $481,000,000 in supplemental appropriations hit a snag in the House Appropriations Committee this week. Committee members still were wrangling about the measure at mid-week.

Funds for the Tennessee Valley Authority's proposed New Johnsonville steam generating plant were not at issue, several committeemen insisted. A subcommittee already had scaled down the $3,000,000 requested for the plant to $2,500,000. But the full committee still had not acted upon this item.

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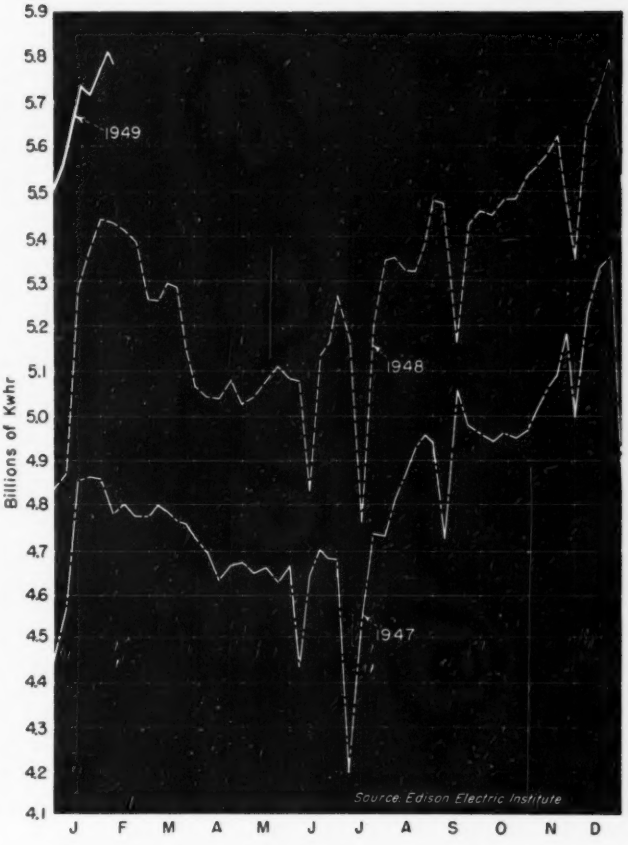
Phoenix Contract Settled

Employees of Salt River Valley Water Users' Association, Phoenix, Ariz., have voted to accept the association's offer of a 7% wage increase. The new contract, reached after five months of negotiation between Local 266, International Brotherhood of Electrical Workers, AFL, and the association, will increase the latter's labor bill by approximately $250,000. Increases are retroactive to Oct 1.



Output Recedes from Record High

The output moved downward during the week ended Feb 5, 1949, according to figures released by the Edison Electric Institute.

Dropping from the all-time record high of 5,810,034,000 kwhr for the week ended January 29, the amount of electrical energy distributed during the first week in February totaled 5,778,476,000 kwhr. This compares with 5,412,361,000 kwhr for the corresponding week of 1948, the 1949 figure representing an increase of 6.8%. The overall percent increase for the week ended January 29 was 7.0%.

The Rocky Mountain States, as in the past few weeks, reported the largest increase of any of the geographical regions, 21.5%, due partly to the heavy use of heating appliances in storm areas. New England reported a smaller decrease, 1.6%, compared with 2.0% for the week ended January 29. The West Central group edged the South Central States out of second place with an increase of 10%, compared with South Central's 9.5%. No substantial changes were shown for the other regions.

Weekly Output, Millions Kwhr

1949		1948		1947	
Feb 5	5,778	Feb 7	5,412	Feb 8	4,801
Jan 29	5,810	Jan 31	5,429	Feb 1	4,777
Jan 22	5,769	Jan 24	5,436	Jan 25	4,856
Jan 15	5,727	Jan 17	5,370	Jan 18	4,857
Jan 8	5,742	Jan 10	5,278	Jan 11	4,853
Jan 1	5,562	Jan 3	4,868	Jan 4	4,574
1948		**1947**		**1946**	
Dec 25	5,508	Dec. 27	4,830	Dec 28	4,442
Dec 18	5,790	Dec 20	5,368	Dec 21	4,940
Dec 11	5,705	Dec 13	5,327	Dec 14	4,778
Dec 4	5,646	Dec 6	5,218	Dec 7	4,673
Nov 27	5,349	Nov 29	4,983	Nov 30	4,448
Nov 20	5,627	Nov 22	5,180	Nov 23	4,765

Percent Change from Previous Year

	Feb 5	Jan 29	Jan 22
New England	− 1.6	− 2.0	− 1.8
Mid-Atlantic	+ 2.4	+ 2.6	+ 1.2
Central Industrial	+ 8.2	+ 8.1	+ 6.3
West Central	+10.0	+11.0	+ 8.8
Southeast	+ 7.9	+ 6.8	+ 5.0
South Central	+ 9.5	+12.3	+12.7
Rocky Mountain	+21.5	+23.3	+22.8
Pacific Coast	+ 5.9	+ 7.4	+ 9.4
Total United States	+ 6.8	+ 7.0	+ 6.1

WASHINGTON COMMENT

WILLIAM B. WHICHARD

THERE ARE TWO ways of looking at President Truman's recent press conference remarks on Washington pressure groups. He asserted that lobbyists who work against programs and policies of the Truman administration are obstructionists. On the other hand, he added, those engaged in attempting to win friends and Congressional votes for Truman-backed legislation are not to be put in the same category. Such groups are working for the common good and in behalf of "progress."

As a commentary on the vagaries of politics, the President's words, spoken in jest, aroused considerable amusement. But if, as now seems likely, the forthcoming Congressional probe of lobbying practices develops as a witch hunt aimed at anti-administration interests only, it's no joke, Mr President.

A case in point very well might be the Justice Department's attitude toward the contract recently negotiated by the Wisconsin Electric Cooperative with the Reynolds Metals Co. Justice is "looking into" the deal whereby Reynolds will supply WEC up to 715,000,000 lb of aluminum conductor over the next 15 years. But that doesn't necessarily mean the Department will take steps to upset this arrangement.

Some of the Department's anti-trusters have sniffed at the Reynolds-WEC plan. They aren't sure yet, but they think they have detected an odor which, in previous cases, has stirred Justice to vigorous action. The suspect scent arises from provisions in the co-op's contract with Reynolds that would make the latter the exclusive supplier of ACSR to rural systems which sign up with WEC under the contract. A principal Justice Department complaint in a suit against American Telephone & Telegraph and Western Electric involved alleged exclusive contracts.

Justice may or may not produce what it considers adequate evidence of illegal effects in the exclusive supply provisions of the WEC-Reynolds contract. Indeed, the agreement gives little surface indication it was designed to establish Reynolds as the sole source of ACSR needed by rural electric systems financed by the Rural Electrification Administration. First, it specifically recognizes contracts already entered into by REA borrowers with other conductor suppliers. And some estimates of the ACSR needs of these systems for the contract period put them well above the minimum of 715,000,000 lb.

On the other hand, the contract puts Reynolds in line for an important chunk of this business. The best Washington sources, including some co-op people, estimate the contract will cover something between 50 and 90% of total ACSR requirements of REA borrowers at various stages of the 15-year period. Obviously, that is sufficient to hurt fabricators now supplying this market. It may be enough to cripple wire makers who have expanded plants to sell more conductor to REA borrowers.

Justice is faced with a dilemma, in any event. After all, it was largely through federal anti-trust actions and other government encouragement that Reynolds and one of its two major competitors got into aluminum production originally. One of those competitors has produced conductor for years; the other is preparing to do so. Can the government, without strong legal compulsion, prevent the third aluminum producer from entering this field? At the same time, the anti-trusters don't want any aluminum-fabricating industry dominated by a metals producer, or by three producers.

TECHNICAL NOTES

ARCHER E. KNOWLTON

Remote control and operation of such outlying items as trash screens and circulating water pumps is a natural concomitant of centralized simplification of power plants.

Carrier communication and relaying come to the fore in each discussion of system expansion and of further concentration of the supervision.

Soil conductivity at a new station site is as important to know as its load-bearing ability. It's almost as bad to rust out of sight as to sink out of sight.

Older transformers are being equipped with breathers to keep out moisture, reduce the risk of trouble and the need for frequent inspection.

Turbines in moderate ratings are being mounted on their condensers. The elimination of separate foundations promises to extend to larger units.

Guys wrapped around poles are less likely to survive corrosion than guys attached to substantial and substantially-protected hardware.

Cavitation resistance of stainless steel is about eight times as good as cast steel and ordinary plate steel about four times as good.

Pilot exciters are being telescoped inside the main exciters to conserve height of hydro units.

Railroad electrification is superior in every respect except first cost. Nothing equals the electric locomotive in traction, maintenance, availability, fuel economy, cleanliness, quietness.

Selenium disks, by a new process, have double the voltage (24) and therefore double the watt-rectification rating. Stacks are smaller, too.

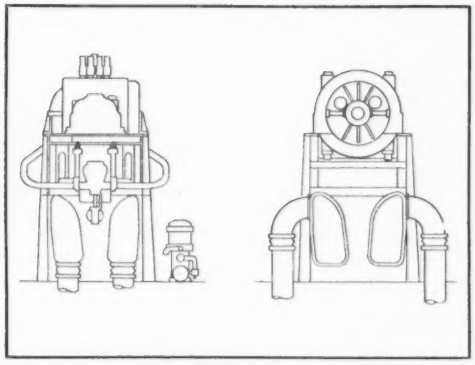


FIG 1—LONGER THAN NORMAL tubes in condenser permitted by cross-flow single-pass design. Turbine-end at left, generator-end at right. Turbogenerator is a 30,000-kw preferred standard unit

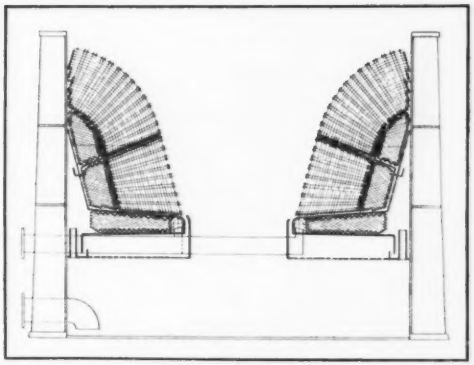


FIG 2—LOWERED CROSS-SECTION provides space for installing direct-contact low-pressure heaters between tube-banks and under turbine exhaust. Second and third heaters mounted externally

Standardized Power Plant Simplifies and Saves

Condenser supports the turbogenerator . . . Heater integral with condenser . . . One whole floor eliminated . . . Building size reduced . . . Practically no moving equipment above operating floor

RALPH C. ROE
President
Burns and Roe, Inc, New York

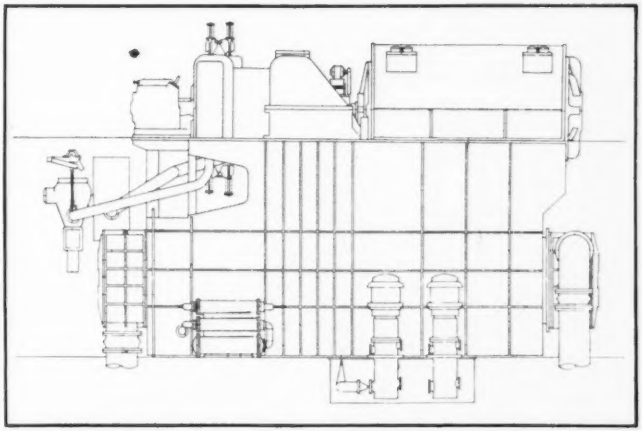


FIG 3—CONDENSER forms the foundation for the 30,000-kw turbogenerator and has the first stage bleed heater integral with it. Closed vertical heaters form part of piping system

THREE FACTORS of high costs which currently confront American utility companies are high initial capital investment, high and increasing costs of fuel and the high and continually rising costs of operating and maintenance labor. One answer to these rising cost problems is standardized design. Consequently, the primary incentive which prompts standardization of power plant design is economy—in initial cost, in operation and in maintenance.

Standardization of power plants in a range of generating unit capacities to meet the needs of the average utility company, say 20 to 60 Mw, is relatively new. Early in 1944, Burns and Roe, Inc, in cooperation with leading equipment manufacturers, began the development of power plant designs with the primary objective of reducing construction costs. Obviously the benefits of standardization and repetitive design were required to accomplish the greatest economy.

The basic idea of standardized power plant design is not entirely new. Standardization has been effected in varying degrees for plants

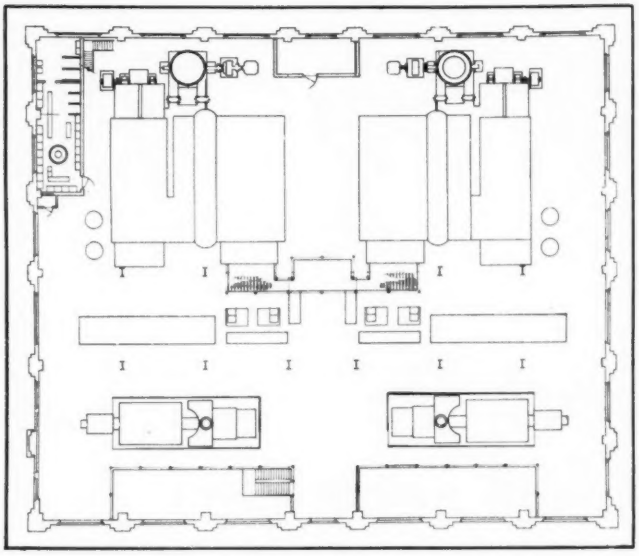


FIG 4—CONTROL BAY located between turbines and the integral-furnace boilers

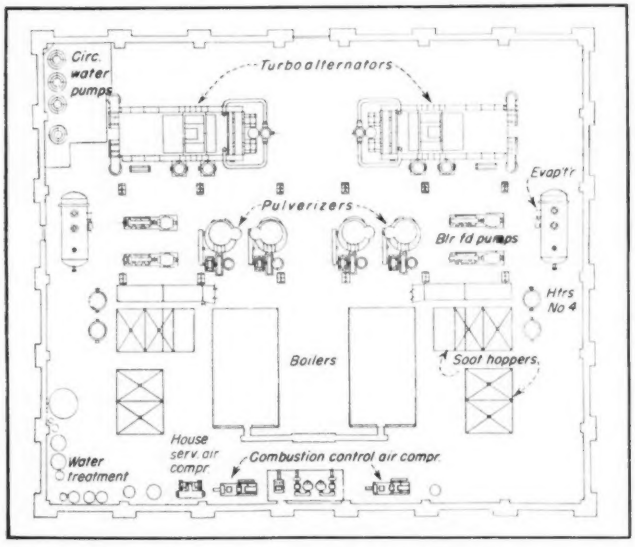


FIG 5—DISPOSITION of auxiliaries in typical twin 30-Mw installation

of 1,000, 2,000 and 5,000-kw capacities.

During World War II, Burns and Roe, Inc, in cooperation with Westinghouse Electric International Co, pioneered in the design of small unit power plants. Standardized unit power plants of 1,000 and 2,000-kw capacities were designed for the decentralized generation of power in China and several European countries. These were "packaged" plants. These unit plants were standardized in the sense that they employed readily available components of similar types and capacities.

Many of the features incorporated in the much larger standardized power plants were developed in close cooperation with the manufacturers of the boiler, turbine, condenser and control equipment. Included are: (1) Turbo-generator mounted on and supported by the condenser (Fig 3); (2) improved condenser design with small piping and the first stage bleed heaters integral to the condenser; (3) the elimination of one floor; and (4) material reduction in the size of the plant building.

Preferred Standard Turbines

The four projected capacities for standardized power plants are 20,000, 30,000, 40,000 and 60,000 kw. The plants are built around the preferred standard turbines of those capacities with a single boiler serving each unit. With this range of power generation, standardized power plants in single, twin or multiple units can meet the average needs of most utility systems. Plans and engineering details have now been finished for one of the four projected capacities. This is the first 20,000-kw unit now approaching completion at Tomkins Cove, N. Y., for the Rockland Light and Power Co.

Maximum savings in the construction, operation and maintenance of standardized power plants are effected by repetitive design. Specified equipment units have been designed after exhaustive and close coordination between the engineers and the respective manufacturers. Careful integration of each piece of equipment into the overall design of the plant permits of no substitutions without loss of economy and efficiency.

Condenser and Auxiliaries

The turbo-generator mounted on the condenser has no parts of unequal vertical height. All of the side plates for the condenser proper are at condenser vacuum temperature internally, and all parts above the condenser are at room temperature, preventing unequal expansion.

The condenser for this unit is a cross-flow single pass condenser, which by reason of design permits the use of longer than normal tubes. This gives the highly desirable characteristics of a 2-pass condenser as far as water flow is concerned. Cross section of the condenser has been lowered (Fig 2). This increases the space

for good steam distribution and makes it possible, in units of 30,000 kw and larger, to install one or more of the direct-contact low-pressure heaters in the space between the tube banks and under the exhaust of the turbine. These low pressure direct-contact heaters are built internal to and integral with the condenser. The second and third direct heaters are external to the condenser. One is adjacent to the throttle in the space between the turbine and the condenser; the second is suitably elevated above the boiler feed pumps to provide a good operating head for these pumps that supply the boiler.

The closed heaters are of the vertical type. They form part of the pipe line and so minimize piping.

Pumps Provide Positive Head

The condensate is stored in the base of the condenser and the storage section of the deaerating heaters. Vertical condensate pumps are provided of the multi-section type, so arranged that there is a positive head on the eye of the first impeller, making it possible to avoid cavitation difficulties.

The turbo-generator shown (Fig 1 and 3) is a 30,000-kw preferred standard unit, with five bleed points. In all standardized plants, throttle pressures and temperatures are in accordance with the preferred standard ratings. Four or five bleed points are utilized, depending upon the size of the machine.

The feedwater cycle is the direct contact heater cycle. For the 30,000-kw plant this cycle provides three low pressure and two high pressure units. Two of the low pressure units are direct contact heaters, and the third is the deaerating heater. The high pressure units are closed heaters with drain coolers.

Feedwater Cycle Advantages

Principal advantages of this cycle are: (1) Simplicity and ease of maintenance due to the absence of tubes in the low pressure heaters; (2) almost entire elimination of terminal differences in the low pressure heaters due to the direct contact of steam and the water being heated; (3) elimination of cascading losses inasmuch as no condensate is degraded in temperature in the major portion of the cycle; and (4) ruggedness and ability to

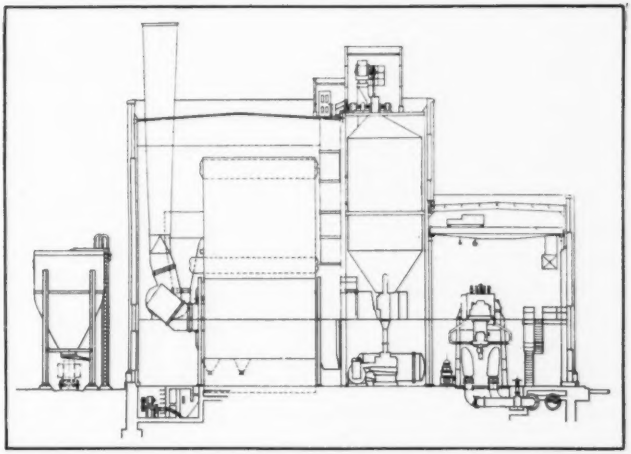


FIG 6—COAL-HANDLING equipment is practically the only moving equipment above the operating floor level. All equipment is readily accessible from the central control station

Advantages of Standardized Design

THE DOMINANT INCENTIVE for the development of standardized power plants was to effect economies in construction, reduce operating costs and lower maintenance expenses. In addition, many other advantages were developed. The outstanding features include:

1. An indicated saving of 7 to 10% in construction.

2. Material reduction in the building sizes. Headroom between the basement and operating floors is lowered from the conventional 25 to 34 ft to an average of 18 to 24 ft. Building cubage is reduced from the usual 30 to 40 cu ft to 22 to 30 cu ft.

3. Important equipment confined to the operating floor and basement. No moving equipment is located above the operating floor (except coal conveyors in coal-burning plants).

4. The carefully engineered arrangement of the boiler turbine and auxiliaries and the economy of space achieved in these plants reduce the amount of piping, electric cable and other interconnections required. This reduces initial capital cost and proportionately lessens replacement costs.

5. Elimination of a separate turbine foundation The condenser acts as the foundation for the turbo-generator.

6. Maximum of factory fabrication. In most plant sizes the condenser is completely fabricated at the factory, including a great deal of the bleed, oil and other small piping and the first stage bleed heaters which are built internal to and integral with the condenser.

7. Centralized control. The control heater bay combines the firing aisle, heater bay and control bay in a single space between the boiler and the turbine room.

8. Flexibility. Boilers have been designed to burn all normal Eastern bituminous and most of the Midwestern bituminous coals. Lignites can be burned upon the installation of larger pulverizers and fans. Oil or natural gas also may be burned as either primary or secondary fuels.

9. Electrical design features simplicity in layout and the use of factory-built equipment to minimize installation costs. Metal-clad switchgear is used with a sectionalized single bus.

take varying loads, however applied, easily and automatically.

Boilers for these standardized power plants are modifications of accepted designs. Particular care has been taken to provide a boiler which is liberal in design and high in reliability and availability. To this end the hydraulic circuits have been checked carefully in both the radiant and convection zones so that steam and water ratios are ample for all operating conditions.

Ease of Cleaning Stressed

Furnaces are designed liberally with metal temperatures well within conservative operating ranges. The spacing of tubes and the construction of convection heat exchange apparatus is arranged for ease in cleaning and to prevent the build-up of slag or other ash deposits.

The operating floor elevation of the boiler is arranged to correspond with the condenser-mounted turbine in order that both may be on the same operating levels. The air heaters and dust collection apparatus are arranged so that both the forced and induced draft fans and their drives are on the operating floor. Coal scales and combustion controls are also located on this floor to further minimize operating labor.

In this 30-Mw design the total floor area required (Fig 4) is 0.496 sq ft per kw for a twin unit, and 0.576 sq ft per kw for a single unit. The respective building volumes per kw are 22.25 cu ft for the twin, and 24.85 cu ft for the single unit. Other economies accomplished in building areas and volumes are indicated in table above.

Building Areas
(30 Mw Units)

	Double Units	Single Unit
Basement Floor	14,790 sq ft	8,500 sq ft
Operating Floor	12,360 sq ft	7,250 sq ft
Heater Floor	2,600 sq ft	1,520 sq ft
	29,750 sq ft	17,270 sq ft

Building Volumes
(30 Mw Units)

	Double Units	Single Unit
Boiler Bay	762,000 cu ft	427,000 cu ft
Heater Bay	261,200 cu ft	144,600 cu ft
Turbo-Gen. Bay	310,500 cu ft	174,000 cu ft
	1,333,700 cu ft	745,600 cu ft

Boiler Room Floor Arrangement

Location of boiler feed pumps, pulverizers, evaporators, ash-handling equipment, water-treating equipment and other auxiliaries is shown (Fig 5) for a twin 30,000-kw unit. Available space at the site determines the location of such accessories as railroad spur, track hopper, coal storage, circulating water intakes and discharge lines, and ash-handling tanks. Such items are arranged to provide for the minimum in piping and conveyor runs to keep down costs of maintenance and replacement.

An evaporator is shown (Fig 5) at each end of the heater bay. This evaporator is built on the unit design principle and is purchased as a unit complete with evaporator condenser, evaporator heater, drip pumps, piping and all accessory equipment. It is built to fit within the established standard head room between the basement and operating floor.

Belt conveyors transport the coal direct from the hopper to coal bunkers and are supplemented with apron feeders for stocking.

Compactness of the standardized power plant design (Fig 6) avoids having moving equipment above the operating floor, with the exception of the coal-handling equipment. All moving equipment is confined to either the operating floor or the basement. Because of the low ceiling height between these two floors and the centrally located stairways, all equipment is readily accessible from the operators' central control station.

The large cylindrical coal bunker provides adequate coal storage with a clear operating aisle beneath the bunker. The design ensures the most direct coal flow, eliminating long runs which lead to endless trouble due to clogging of coal.

The deaerator is located in the same bay with the boiler feed pumps at sufficient height to eliminate any possibility of flashing and vapor binding during change of loads. This location also permits the boiler feed pumps to be served with the most recently deaerated water. The arrangement gives the straightest possible run of suction piping. This provides added protection against sudden changes of load.

Landscaping Substations

General Electric Photos

TWO TYPES of landscaping that help blend substations in residential areas. (Left) Factory-built 2,000-kva single circuit substation of Pacific Gas & Electric Co, San Francisco. (Right) 2,000-kva unit substation on the Borough of Vineland, N. J. System

Fixed and Mobile Kenotrons Provide Flexible Testing

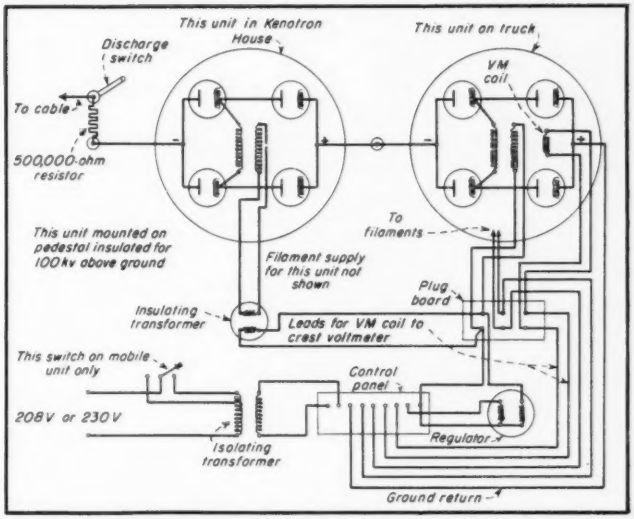
C. H. SMITH
Technical Standards and Test Section
Boston Edison Co

BOSTON EDISON CO recently provided for fixed and mobile kenotron testing in connection with its new Mystic-Woburn 110-kv cable.

A "line" rectifier was left at the Mystic generating station following acceptance tests on the new cable, a "ground" unit being used for mobile service. Most of the testing is to be at 100 kv or less. Tests above 100 kv are made by spotting the mobile unit outside the Mystic kenotron house, connecting its rectifier to the Mystic controls and operating the rectifier (while on the truck) in series with the fixed insulated unit. As another fixed unit is available at the L Street station, the company now possesses a testing combination of maximum flexibility. The mobile unit is also available for use on cables which do not terminate at either of the above steam plants. The mobile outfit is a new 100-kv full-wave set.

At Mystic a 208-v single-phase supply from the station service bus serves the testing outfit. The Mystic set is specially housed near the terminals of the 110-kv cable to Woburn. A motor-driven regulator is provided with interlocked "lower" and "raise" controls. It is impossible to close the main contactor at any other position than "full buck," thus preventing voltage application to the cable on closing the contactor. When the main contactor is opened after a test, the regulator automatically returns to full buck position.

From the regulator, as shown in the diagram, operating voltage for the rectifier goes to an insulating transformer, as do the filament supply leads, since the rectifier remaining at Mystic is the "line" unit and is on a pedestal insulated from the ground.

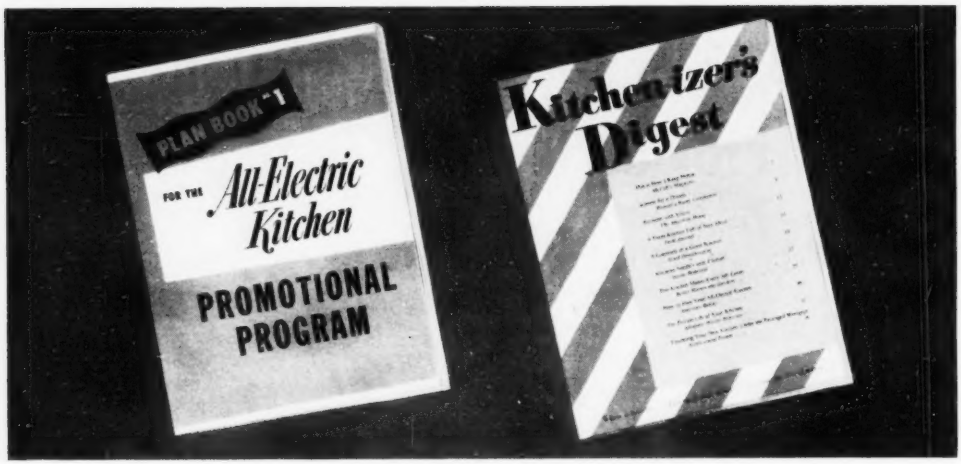


WIRING DIAGRAM of fixed and mobile units as combined for testing at potentials above 100 kv. Whether the rectifier of the truck set is used in mobile service or as the "ground" unit of the 200-kv outfit, the connections are the same for these flexible test units

This makes the equipment available as a line unit for 200-kv tests. To make this equipment available for testing cables in the Mystic plant's 13 and 25-kv switch houses, test cables with terminal potheads have been installed between the switch and test houses.

Two voltage connections are available. Four rectifier tubes can be connected in bridge circuit for 100 kv at 250 ma. They may also be connected in parallel for 50 kv, two tubes on each end of the winding and all plates tied together (500 ma). If the "ground" unit (truck outfit) is also in use, the rating becomes 250 ma at 200 kv, 500 ma at 100 kv, and 1 amp at 50 kv. It is expected that this latter connection will be very effective in reducing difficult faults that are sometimes encountered.

The mobile unit has a 10-ton chassis, accessible equipment, and conveniently located auxiliaries. A 2300-v transformer is included for energy supply where neither 208 nor 230 v is available. A 1-kv thyratron for reducing and locating faults is also included. Other facilities include accessibly located reels and leads, condensers with ball gap and resistor for fault location by discharge, and a power bridge. It is standard practice to bridge all faults where conductors are continuous before trying to locate them. Time is saved in seeking approximate locations of faults before starting out. Where the fault is of such high resistance that it cannot be reduced and the condenser discharge method is necessary, Boston Edison has found the bridge measurement especially useful.



PLAN BOOK tells the utilities how to put the Program to work; consumer booklet advises on every phase of kitchen modernization

"Of Course—It's Electric!"

All-electric kitchen program gets underway with complete provision of advertising and other promotional material

T. O. McQUISTON
Chairman
Electric Kitchen and
Laundry Committee, EEI

FOR YEARS the electrical industry—utilities and makers of appliances—has watched the gas industry try to stem the advances in public acceptance of electric cooking, water heating, refrigeration, and clothes drying. Post-war, the competition of gas has been reinforced by the entrance of liquid petroleum gas on the national scene.

It used to be that the power companies could console themselves with the thought that suburban and rural areas not reached by gas supply systems offered a huge market that just naturally would go electric. But L-P exploded that bubble of complacency. The electric utilities suddenly discovered that competition did not stop where the gas mains ended and was much more serious than they had thought.

BILLBOARDS will assert "Of course—It's electric!" to every passing eye

Thus pulled up short, the electric folks took another look at the gas competition. They realized they were being attacked in national campaigns of gas promotion intelligently conceived and practically executed. They saw the old gas stoves and heaters modernized and improved by research and invention into handsome and efficient appliances claiming virtues of control, cleanliness, performance, and appearance as great as, or greater than electrical devices. It became plain them that here were not just the efforts of gas range makers to sell their products. Here was a planned, coordinated, promotion of gas service in the home, well financed and skillfully organized, in direct attack against the electrical way of living.

Two years or more ago a few electrical men began to discuss this situa-

tion and the more they talked of and explored it, the more they convinced themselves and others that something should be done about it. One of the first conclusions reached was that the electric utilities, not the manufacturers of appliances, were responsible for the failure to react effectively to the gas offensive. The utilities have a prime interest in electrical living and theirs is the duty to encourage and accelerate the trend in that direction. No such obligation rests with the appliance makers. Their interest is in selling their products: whether gas or electric makes no difference. No more evidence of this is needed than the names of manufacturers who make both electric and gas appliances.

Tremendous Market

Also, these men made some calculations of the market that was at stake. They found that if all kitchens in wired homes were electrified the market for appliances would be enlarged by $35,000,000,000, residential use of electricity would be increased by over 165,000,000,000 kwhr, and electric utility revenue would rise about $2,350,000,000. And these figures cover only the major appliances —range, water heater, refrigerator, dishwasher, garbage disposer, and home freezer. Improved lighting and larger use of small appliances would add to these figures substantially.

Another consideration was that service to homes is the most stable element in the electricity supply business. Conditions that cause large effects in sale of energy to other classes of customers have less effect on residential service.

Here then, was an immense potential market of most attractive character, threatened by aggressive, intelligent competition. Obviously the time had come for the electric utilities to take action. After much discussion and a great deal of hard work, the All-Electric Kitchen Program was offered to the electric utilities as an industry-wide, national offensive to sell one way of living, exclusive of any other way.

The Program is set up on the slogan, "Of Course—It's Electric!", the ultimate assertion of excellence in any electric application or appliance. Central element in the Program is the *Kitchenizer's Digest*, a 40-page consumer booklet to which ten leading national authorities on kitchens contributed their knowledge. It contains suggestions on color, decoration, design, selection of appliances and other equipment, arrangements and groupings, financing, all the considerations that arise in the various aspects of kitchen modernization.

A feature of the Program is a 27-min color movie, *The Constant Bride*, which tells in entertaining fashion a comprehensive story of the all-electric kitchen and its benefits. Included are a series of newspaper ads and one of radio spot announcements, bill board posters, window display cards, envelope inserts, truck posters, employee badges and other promotional aids. The *Digest*, motion picture, and other items are available to electric utilities from the Edison Electric Institute in quantities as desired.

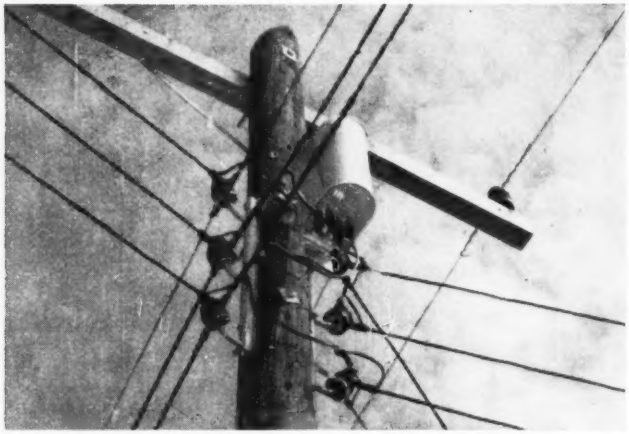
The public will profit from vigorous competition between electricity and gas for service to the home. The All-Electric Kitchen Program, material for which was prepared by the Ralph H. Jones agency, is intended to equalize this competition.

When a Kitchen is
Practical and Pretty
...of course, it's electric!
An All-Electric Kitchen is practical because you base your plans on an Electric Range, Electric Refrigerator, Electric Dishwasher and plenty of electric outlets. Around these appliances you build your "Electric Time-Saving Centers." This equipment does much of your work for you automatically. And your All-Electric Kitchen is pretty, because there's practically no limit to what you can do decoration-wise, due to the cleanness of this equipment in appearance and operation. Yes, an All-Electric Kitchen is both practical and pretty!
AN all-electric KITCHEN includes:
Cooking Center.
Dishwashing Center.
Adequate Wiring.
Refrigeration Center.
Kitchenizer's Digest
FREE!
GET THIS VALUABLE BOOK!
(SPACE FOR UTILITY NAME)

NEWSPAPER ADS to sell the electric idea are available in a variety of copy and layouts

Low-Voltage Capacitor Applications

Newly available capacitor units for use on secondary systems offer opportunities to increase load carrying ability of existing transformers and secondaries . . . Study defines field of economic application; discusses technique of proper application



LOW-VOLTAGE CAPACITOR installed on a typical distribution pole. Units are made in only one size; 3 kvar 240 v. They consist of ten 0.3-kvar sealed units in parallel

W. R. BULLARD
and
CHASE HUTCHINSON
Electrical Engineers
Ebasco Services Inc
New York

IN TIMES of critical generating capacity, substation and distribution transformer capacity and labor, the advantages of secondary capacitors are particularly attractive. They reduce losses in both secondary conductors and distribution transformers and in this way increase load carrying ability. Moreover, a primary system derives the same benefits from secondary capacitors as it does from a slightly greater amount of primary capacitors.

Attracted by these considerations Ebasco Services, Inc, has initiated a study of the possibilities of secondary capacitors on modern systems. As a result, one manufacturer now offers a low-cost 3-kvar capacitor that is specially designed for use on overhead secondary systems.

This low-cost secondary capacitor is a 240-v, 3-kvar unit housed in a sheet aluminum box equipped with two bushings and a suitable base for bolting to the pole. It weighs about 30 lb and consists of ten 0.3-kvar hermetically-sealed capacitor units connected in parallel. This parallel combination is suitably surrounded with press board, slipped into the container which is then filled with compound.

Cost of the unit is slightly under $10 per kvar. Lower per kvar costs seem to hinge on sustained use of one size unit, yielding large production of identical units. Potentially, future costs in the order of $7 to $8 per kvar appear attainable.

Because of the I^2X losses in the transformer, one kvar of secondary capacitors performs all of the functions of about 1.04 kvar of primary capacitors. In addition it reduces current in the secondary conductors and the distribution transformer cutting kilowatt losses and releasing load-carrying capacity. Thus where primary capacitors are justified, secondary capacitors are also justified IF benefits to the secondary and transformer outweigh the higher cost of the secondary capacitor. In other words, secondary capacitors should be used when:

1. Per kvar capitalized benefits of secondary capacitors
   is greater than
2. Cost per kvar of secondary capacitor installed ($14 used)
   minus
3. Cost per kvar of primary capacitors install ($7 used)

This expression is the basis of the economic picture developed in this report. It is a picture that presents only those benefits peculiar to the secondary capacitor. It has been evaluated for a few typical transformer secondary systems. The results will be discussed.

Utility owned secondary capacitors might be located in either of two places: (1) Just ahead of the customer's meter or (2) on the secondary pole line. The latter location has been chosen because the per kvar cost of capacitors falls rapidly as size goes up and because it appears lower losses will occur.

Why lower losses will occur may be obscure. It is due to diversity of

Based on a paper by the authors before the Power Distribution Conference, University of Texas, Austin, Dec 6-8, 1948

reactive loads and the fact that reactive power would have to flow from all other customer capacitors to the one or two customers having a high reactive demand at a particular moment. With present scant knowledge of customer reactive load characteristics and today's capacitor prices the 240-volt utility-owned customer capacitor appears impractical. Increased knowledge and developments in housing and mounting may make them attractive in the future.

Location and Size

Location of capacitor bank to produce minimum secondary copper loss can be found from the fact that copper losses due to reactive current are determinable independently of copper losses due to energy current. A family of curves (Fig 1) computed in this manner shows the location and size of a secondary capacitor bank which produces the minimum kw loss in the secondary wire when reactive load served from each pole is the same. Optimum location is seen to be a function of amount of correction. It varies from 60% of the radial secondary run (measured from the transformer) for 100% correction to nearly 100% for 20% correction. Roughly speaking location should be $\frac{1}{2}$ to $\frac{3}{4}$ of the secondary run. The optimum amount of capacitors is about 75% of the total reactive load on the secondary run. This optimum amount will cause minimum kilowatt loss in secondary wires at the time of peak load. During off-peak hours, however, it may cause an increase in kwhr losses due to low reactive load and consequent higher light load losses. When these energy losses and the kwhr copper losses in the transformer are evaluated the effect is to reduce this optimum size. But when such factors as released load-carrying ability are evaluated it is found there is no optimum amount of capacitors for the transformer secondary combination as a whole. Considering all costs, the value of the benefits of capacitors decrease as more and more capacitors are installed. Nevertheless, the location derived is valid and the optimum size is indicative of the maximum amount of secondary capacitors which should be installed on a secondary run.

Over-all cost comparisons for 10, 15 and 25-kva two-way secondary transformer systems loaded to 100% and 150% of transformer rating, and for loads having power factors of 95%, 90% and 85% have been computed. To simplify the computations, the value of the increment of secondary conductor load ability released by secondary capacitors has been omitted. Consequently the actual benefits of secondary capacitors are somewhat greater than indicated by the curves. These curves together with the basic assumptions are shown in Fig 2.

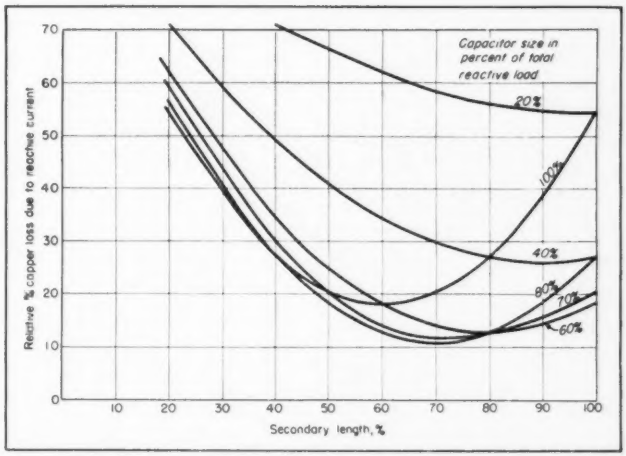


FIG 1—OPTIMUM LOCATION and size of secondary capacitor on radial secondary having uniform load. Each trace is for a different capacitor size in percent of total reactive load

Two important conclusions can be drawn from these curves:

1. For well loaded transformer secondary systems having peak load power factors below 90%, appropriately installed secondary capacitors in amounts up to 50% of reactive load afford attractive return.

2. Considering evaluated capital benefits as a credit to cost of secondary capacitors installed, the net cost of appropriately located secondary capacitors will approximate the costs of primary capacitors when installed in following amounts.

Load Power Factor	Amount of Secondary Capacitors in Per Cent of Lagging kvar to Break Even with Cost of Primary Capacitors	
	Transf Loading 100%	Transf Loading 150%
95	50 to 60%	50 to 100%
90	75 to 90%	80 to 100%
85	Greater than lagging kvars	

Installation of any lesser amount of secondary capacitors offers some economy over a like amount of primary capacitors.

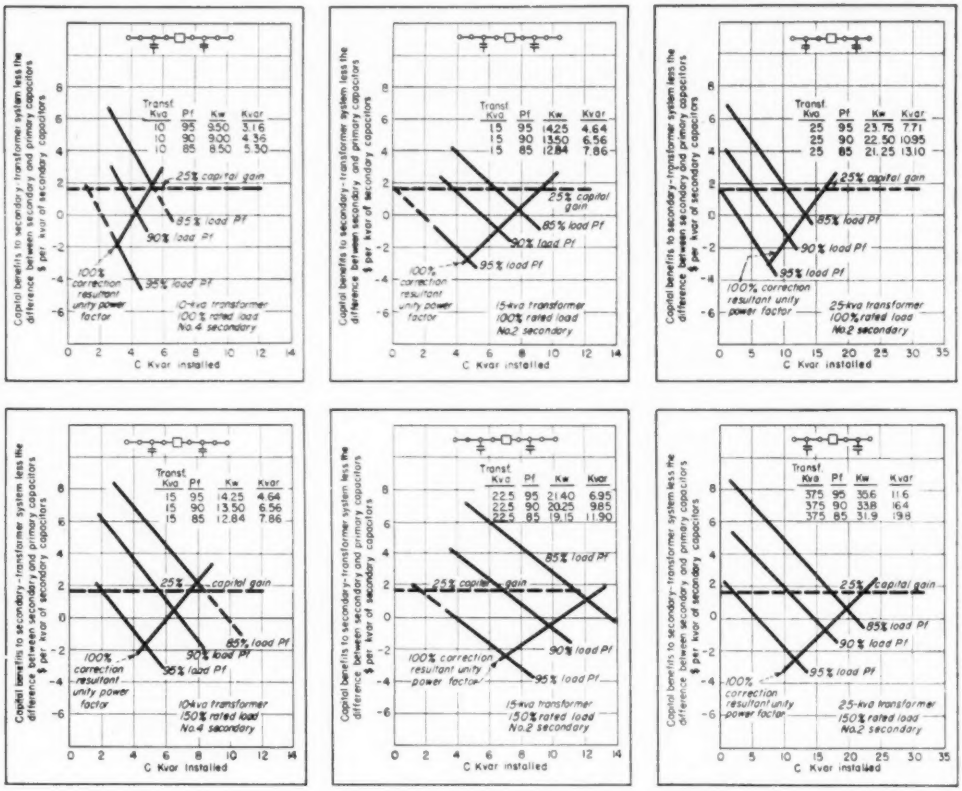
In a growing load situation, installation of secondary capacitors up to the "break even" amount may be desirable in order to *immediately release* a maximum amount of generation, transmission and distribution capacity. Then in the future when transformer-secondary loads are greater the secondary capacitors will provide attractive economics over primary capacitors.

System Considerations

With both primary and secondary capacitors, savings decrease as the amount of capacitors increases. A point is finally reached where some capacitors must be switched on and off periodically to control voltage. Such switching can be done more economically on primary capacitors than on secondary capacitors. Sound economics indicate the proportion of primary and secondary capacitors installed should be such as to provide a maximum over-all saving for the total installation.

A system having few primary capacitors should not install additional primary capacitors as long as secondary capacitors show a saving over primary capacitors—*unless* either of the following conditions occur:

1. Light load voltage conditions cause either the substation transformer tap range or the regulator


Capital benefits to secondary-transformer system less the difference between secondary and primary capacitors $ per kvar of secondary capacitors
C Kvar installed
Transf Kva Pf Kw Kvar
10 95 9.50 3.16
10 90 9.00 4.36
10 85 8.50 5.30
25% capital gain
85% load Pf
90% load Pf
95% load Pf
100% correction resultant unity power factor
10-kva transformer 100% rated load No.4 secondary
Transf Kva Pf Kw Kvar
15 95 14.25 4.64
15 90 13.50 6.56
15 85 12.84 7.86
15-kva transformer 100% rated load No.2 secondary
Transf Kva Pf Kw Kvar
25 95 23.75 7.71
25 90 22.50 10.95
25 85 21.25 13.10
25-kva transformer 100% rated load No.2 secondary
Transf Kva Pf Kw Kvar
15 95 14.25 4.64
15 90 13.50 6.56
15 85 12.84 7.86
10-kva transformer 150% rated load No.4 secondary
Transf Kva Pf Kw Kvar
22.5 95 21.40 6.95
22.5 90 20.25 9.85
22.5 85 19.15 11.90
15-kva transformer 150% rated load No.2 secondary
Transf Kva Pf Kw Kvar
375 95 33.6 11.6
375 90 33.8 16.4
375 85 31.9 19.8
25-kva transformer 150% rated load No.2 secondary

Assumptions Used in Calculating Curves

Load factor	40%
Transformers installed 7200 v	
$ per kva of rating 10	$19.00
15	$15.70
25	$13.05
37.5	$11.60
Loss cost—kw of demand on system peak	$200.00
—kwhr each	$ 0.007
Fixed charges for capitalizing kwhr losses	16.6%
Maximum secondary voltage drop	3.0%
Secondary Spans	120 ft
Kilovar value for evaluating I²X	$6.00

Loss factor was assumed to be 20% prior to correction with secondary capacitors. It was adjusted slightly after correction with secondary capacitors as losses at light load increased due to over correction.
Cost of primary capacitor installed $ 7 per kvar
Cost of secondary capacitor installed $14 per kvar
Secondary 3-wire single-phase 240-v feeding two ways from transformer with uniform load per pole and no diversity between pole loads. Note use of diversified loads increases kw losses in secondary at time of transformer peak load—non-diversified loads were used for simplicity and conservative results.
Released capacity in secondary conductor was not evaluated nor was an estimate of its value included. It is not an item of much consequence for secondary (overhead) conductors are usually limited by voltage drop

FIG 2—CAPACITORS ARE ECONOMICAL if capitalized benefits to the transformer-secondary system are greater than the difference in installed cost of primary and secondary capacitors

Load power factor curves, above, indicate the capital gain or loss to be expected with capacitor installations of different size on secondary systems of transformers of different ratings and loadings

range to be exceeded—in which case voltage controlled automatically switched primary capacitors are indicated since the per kvar cost is lower.

2. Light load reactive conditions cause loss of generator voltage control or loss of generator stability in which case automatically switched primary capacitors are again indicated.

The effect of secondary capacitors on primary and secondary voltage levels is such that application may follow either or both of two methods:

1. Secondary capacitors may be installed as a function of transformer ratings. The resulting voltage rise may be considered as having two components: (a) A uniform rise in voltage due to rise in transformers and secondaries and (b) a rise in voltage on the primary which increases as the distance from substation increases.

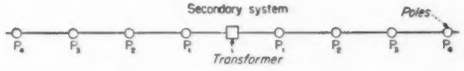
2. Secondary capacitors may be applied in amounts greater than (1) up to the maximum amounts indicated by the charts of Fig 2 in locations where the increased voltage rise can be used to reduce capacity bottlenecks due to voltage drop.

TABLE I—Location of Greatest Amount of 3-Kvar Capacitors For 25% Capital Saving In Secondary Transformer System

Load Power Factor	Transformer Rating 10	15	25	37.5
100% LOADING OF TRANSFORMER				
95	0	0	0	0
90	1 at T	1 at T	2 at P_2	1 at T 2 at P_2
85	2 at P_2	2 at P_2	1 at T 2 at P_2	1 at T 2 at P_1 2 at P_2
150% LOADING OF TRANSFORMER				
95	1 at T 2 at P_2	1 at T 2 at P_2	1 at T 2 at P_2	2 at P_2 1 at T 2 at P_2
90	1 at T 2 at P_2	1 at T 2 at P_2	1 at T 2 at P_1 2 at P_2	1 at T 4 at P_1 2 at P_2
85	1 at T 2 at P_2	2 at P_2 2 at P_2	1 at T 2 at P_1 2 at P_2	1 at T 4 at P_1 2 at P_2

TABLE II—Location of Greatest Amount of 3-Kvar Capacitors or No Capital Loss or Savings In Secondary Transformer System

Load Power Factor	Transformer Rating 10	15	25	37.5
100% LOADING OF TRANSFORMER				
95	0	0	1 at T 2 at P_2	1 at T 1 at T 2 at P_2
90	2 at P_2	2 at P_2	1 at T 1 at T 2 at P_2	1 at T 1 at T 2 at P_2
85	2 at P_2	1 at T 2 at P_2	1 at T 2 at P_2 2 at P_3	1 at T 2 at P_1 2 at P_2
150% LOADING OF TRANSFORMER				
95	1 at T	1 at T	2 at P_2	1 at T 2 at P_2
90	2 at P_2	1 at T 2 at P_2	1 at T 2 at P_2 2 at P_1	1 at T 4 at P_1 2 at P_2
85	1 at T 2 at P_2	1 at T 2 at P_2 2 at P_3	1 at T 4 at P_1 2 at P_2	1 at T 4 at P_1 4 at P_2



Method 1 will give greater per unit loss reduction, greater per unit capacity release (thermal) and a greater "return" per dollar than Method 2. Method 2, however, may provide a greater loss reduction and capacity release *in the places needed*.

Best over-all results may be expected when a moderate amount of correction is installed throughout the circuit. Then as conditions dictate, the correction may be increased to obtain desired voltage levels. The over-all endeavor should be to use Method 1 to extent permitted by the need for capacitors in Method 2.

When a substation supplies a number of distribution circuits it frequently happens that the express feeder portion of the various circuits have widely different lengths. To the extent of differences between the light load drops of the several feeders there may be need for a fixed rise in voltage on one or more feeders. This may be obtained in several ways:

1. By installing a suitable density of secondary capacitors on the circuit or circuits needing the greater rise.
2. By use of secondary capacitors on a uniform density basis and obtaining such *special* voltage rise by means of primary capacitors.
3. By combination of (1) and (2).
4. By other forms of fixed boost.

Application Procedure

Because the secondary capacitor must be applied in small amounts to obtain maximum savings, relatively little time can be spent engineering a specific installation. Obviously some kind of simple and effective application procedure must be used.

Probably the simplest application procedure is to install secondary capacitors as a direct function of distribution transformer capacity.

A further refinement might include consideration of primary circuit power factor measurements. By subtracting the estimated I^2X in the primary conductors and transformers from the reactive load on the primary, these measurements can give rough indication of conditions on secondaries. Secondary capacitors may be applied for this average secondary power factor using the accompanying charts of Fig 2 as a guide to the maximum amount or density that should be installed. Then with a knowledge of total amount of secondary capacitors available and connected transformer capacity involved a suitable temporary application table can be made.

Tables I and II are application tables based on the maximum amount of secondary capacitors which can be installed and (a) break even as compared to primary capacitors and (b) show a 25% capital saving over primary capacitors. This approach can be used advantageously when the available secondary capacitors are to be installed to obtain greatest per unit loss saving and per unit capacity release *without regard to location*. For example, if a relatively small amount of secondary capacitors is to be in-

(Continued on page 156)

TABLE III—Voltage Rise Due to Capacitors

Wire Size	1 Phase Loop Ckvar M ft (a) 8" Spacing 240 V	12" Spacing 240 V	3 Phase Ckvar M ft 53" Eff Spacing (b) 2.4 Kv	4.16 Kv	7.62 Kv	13.2 Kv
(1)	(2)	(3)	(4)	(5)	(6)	(7)
6	5.19	4.75	370	1,120	3,750	11,300
5	—	—	380	1,140	3,820	11,500
4	5.55	5.09	385	1,160	3,890	11,700
3	—	—	390	1,180	3,960	11,900
2	5.85	5.33	405	1,220	4,080	12,200
1	—	—	410	1,240	4,160	12,500
1/0	6.15	5.56	420	1,260	4,220	12,700
2/0	—	—	430	1,285	4,310	12,900
3/0	—	—	435	1,305	4,390	13,200
4/0	6.74	6.08	445	1,340	4,490	13,500

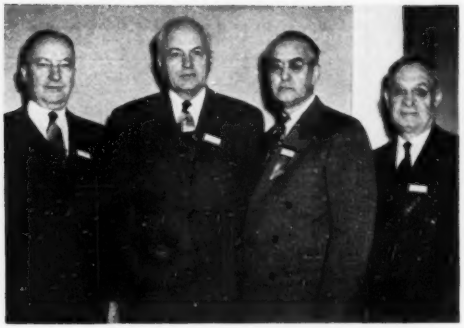
(a)—These Ckvar M ft are those necessary to cause a one per cent rise in voltage on a single-phase secondary loop, ie,

$$\% \text{ Rise} = \frac{\text{Single Phase Ckvar} \times \text{M ft}}{\text{Constant from Col (2) or (3)}}$$

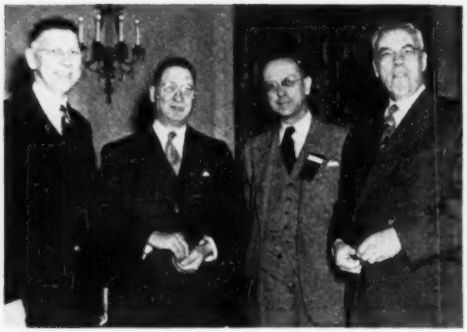
These constants should be multiplied by 2.0 if they are to be used on 3-phase secondaries

(b)—These Ckvar M ft are those necessary to cause a one per cent rise in voltage on a 3-phase line, ie,

$$\% \text{ Rise} = \frac{\text{3-Phase Ckvar} \times \text{M ft}}{\text{Constant from Col (4) to (7) incl}}$$



Among AIEE officers were: R. T. Henry, Director; E. B. Robertson, Director; G. N. Pingree, Vice-president; W. C. Smith, Director



G. R. Milne, C. R. Beardsley, James F. Fairman, AIEE presidential nominee, and L. B. Bonnett, all of Consolidated Edison Company

AIEE SESSIONS EVALUATE

A Consolidation of Progress. This probably best characterizes the wide and varied subjects at the Mid-Winter General Meeting of AIEE held in New York's Statler Hotel January 31 to February 4, 1949.

There was no official theme around which the week-long program of technical sessions and conferences turned. Any attempt to assess the entire meeting must accept the general tendency of authors and discussers to weigh and evaluate experience with the more radical developments of the past three or four years.

In some instances—notably the symposium on gas turbines for power generation—a conservative attitude was observable. In several instances this reflected either technical or economic obstacles, or both, that discount enthusiastic early hopes.

Exception was the conference on fluorescent lighting. Here engineers reviewing a decade of experience with fluorescent lighting could find nothing to check full exercise of imaginative application.

In the field of Transmission and Distribution a new copper conductor material was described that brings to utility overhead systems wire with 15 to 20% higher current rating. Extensive field data on voltage recovery characteristics of distribution systems, presented during the week, should spur development of standards for testing distribution protective devices long vaguely defined. A re-evaluation of the economics of distribution transformer loading practice that tended to upset the conclusions of earlier investigations also attracted attention in Tuesday's afternoon session.

SYSTEM ENGINEERING

Equivalent Circuits for Power-Flow Studies. J. B. Ward, *Purdue University*.

Simplification for network analyzer studies of increasingly intricate interconnections based on constant-current treatment of elements.

Design of Boilers and Control for Fluctuating Loads. P. S. Dickey and P. R. Loughlin, *The Babcock and Wilcox Co.*

Old units unable to carry load swings. Modern units designed for them. Factors in pick-up capability. Psi and frequency recovery. Controls improved for same objectives.

Effect of Fluctuating Load on Steam Turbines. R. L. Reynolds, *Westinghouse Electric*.

Recommends maximum rate of 2% and 2 F per min. up or down. Need indicated for closer control of system frequency. Newer turbines can withstand fluctuations better than old.

Improvement in power interchange and load allocation techniques continues. A closer tie-in between combustion control and electrical control was noted. In the discussion it was brought out that much remains to be learned about the effect of this practice on plant efficiency. Some engineers still prefer to rely on the inherent steam generating capacity of modern boilers to instituting frequent functioning of combustion control equipment (every three or four minutes). A recent survey showed that only three out of fifty steam plants have as yet undertaken to carry electrical control impulses stimulated by load or frequency requirements into the boiler house control layout.

Consolidated Edison (N. Y.) is working on spreading the load between high and low pressure units at Sherman Creek. Blocking relays are recommended in transferring proportional load control to various boilers. Increased number of valves in modern turbines smooths down incremental speed steps. Further cooperation between utility engineers, turbine, boiler and control manufacturers will yield progressive results.

In his conference paper on the operating view of fluctuating load problems in steam plants, G. H. McDaniel, American Gas & Electric Service Corp. said that responsibility for maintaining frequency is placed on an area basis. Highest pressure and temperature units participate in regulation of load. Response of 10% in 5 min. is considered safe. Also that automatic frequency and tie line control expand into combustion control.

In a conference presentation, E. E. Parker and C. W. Elston of General

T. G. LeClair, Comm. Edison; V. Siegfried, Amer. Steel & Wire; H. M. Turner, Yale; H. A. Winnie, G. E.; F. E. Sanford, Copper Wire Eng.

C. F. Wagner, Westinghouse Electric; H. P. St Clair, American Gas & Electric Service; J. R. North, Commonwealth & Southern

RECENT ENGINEERING ADVANCES

Electric posed the question "Are modern high pressure high temperature turbines suitable for use with system speed and load control?" Modern turbines of the "diaphragm and wheel construction" are highly satisfactory. An instantaneous load change of 25% rating or 60% over 10 min. is permissible (20 min. with 100 F. change at throttle and 60% load change).

GAS TURBINES FOR POWER GENERATION

Two Gas Turbines For Power Generation And Other Applications. Alan Toward, *General Electric*

Status of development of 3,500-kw simple-cycle (17% eff) locomotive type gas turbine and 5,000-kw high efficiency (28%) unit. Both units are being built for power generation burning gas or Bunker C fuel oil. Displacement of large steam turbine seems unlikely but expected use of coal as fuel should extend usefulness.

A 3,000-Horsepower Gas Turbine Power Plant. J. S. Haverstick, *DeLaval Steam Turbine Co.*

Performance and description of experimental 3,000-hp gas turbine power plant. Open cycle used without intercooler, reheat or regeneration. Pressure ratio 6:1, turbine inlet temperature 1300 F. Unique features are 3-stage mixed flow compressor adapted to high-speed operation; power output shaft of unit independent of compressor and turbine.

Performance Characteristics of Speed Governors on Automatic Extraction Turbines Driving Electric Generators. L. B. Wales, *General Electric.*

Describes method of modifying compensated speed governor control system to control overspeed on automatic extraction turbines connected electrically in parallel with other units. Scheme prevents extraction pressure regulator from supplying more extraction steam than is just required to generate load on machine.

Outage Rates Of Steam Turbines and Boilers And Of Hydro Units. Report of AIEE Joint Subcommittee on Application of Probability Methods To Capacity Problems.

Outage performance of boilers and turbo generators for years 1939-1944 as gathered by Prime Movers Committee of Edison Electric Institute together with data on distribution of turbo-generator and boiler outages by length. Data show that out of 1,448 unit years of record forced outage in percent of exposed time is 0.46% on hourly basis; average duration of outage 1¼ hr. Of the 297 outages, 197 were less than 2-days duration.

Gas Turbines In Stationary Power Generation. F. T. Hague, *Westinghouse Electric.*

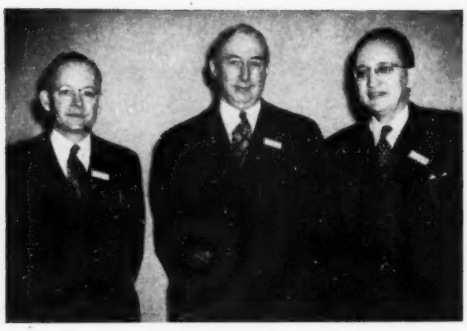
Today's gas turbine will serve power generation field best by supplementing, not challenging, steam plants. It has economic possibilities wherever fuel prices are one-third to one-fifth of coal at mine mouth or load factor is less than 10% and first cost low enough. Has aptitude for peaking service that steam plants can't match. Its cycle efficiency increases three times as fast as in a steam plant for higher top temperatures. Future promise depends use of temperatures 300 to 500 F above present 1250 F level.

To be competitive in power generation service the gas turbine will have to offer thermal efficiencies of 30% or better. This was the opinion of E. S. Dennison of Elliot Co. in a conference paper on gas turbine developments. While these efficiencies are not within reach of turbines now being built, Dennison saw two avenues of development open: (1) An increase in operating temperature to 1,800 or 2,000 F, and (2) adoption of a more elaborate cycle. Materials and methods of cooling are needed before higher temperatures can be used. But the compound cycle offers means of getting satisfactory efficiencies with temperature between 1,200-1,400 F.

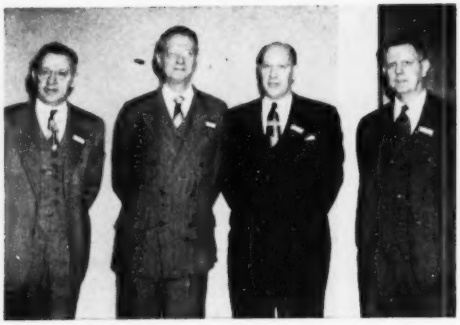
For peak load and end-of-transmission line service, W. B. Tucker, Allis Chalmers Mfg Co, suggested a gas turbine described as a 7,500-kw 3,600-rpm, single-shaft, simple-cycle with regenerator unit. Fuel-to-bus efficiency would be around 21%. The turbine is a six-stage reaction unit delivering 32,000 hp to the compressor when inlet gas temperature is 1,300 F and compressor air inlet 80 F at 1,000 ft altitude.

Five types of drives for testing aircraft gas turbine compressors were compared in a conference paper by D. W. Knowles, of A. V. Roe, Canada Limited. They embraced: Ward Leonard system; mercury-arc rectifier, d-c drive; composite a-c, d-c drive; electro-pneumatic drive and steam turbine drive. Knowles found the steam turbine drive the most suitable, although relatively expensive. Of the electrical drives, flexibility of the electro-pneumatic ranked it best in spite of high first cost.

In an absentee discussion, embrac-



J. O'R. Coleman, Stone & Webster Engineering Corp.; A. E. Silver, Ebasco (retired); M. D. Hooven, Public Service Electric & Gas Co



E. S. Bailey and H. C. Louis, Consolidated Gas Electric Light & Power; James De Kiep, Electric Machinery; W. A. Lewis, Illinois Institute

ing all papers. Philip Sporn, American Gas & Electric Co, observed that although the gas turbine may offer potentialities with gas and oil fuels, a coal burning unit will be required before its place in the power generation field can be clearly defined. Even if coal-burning gas turbines are developed he observed that the gas turbine must better the 9,300 BTU per net kwhr performance now obtainable with 2,000 psi steam units.

Richard Harold, Sulzer Bros, observed that attainment of high efficiency with higher temperatures was merely a matter of how much money can be spent for higher temperatures. It is cheaper and easier to get high efficiencies with closed or semi-closed cycles. W. A. Wilson, Elliott Co sponsored this view also; said that compound cycle is apt to be used most.

TRANSMISSION AND DISTRIBUTION

Distribution Transformer and Secondary Conductor Economics. Bryce Brady, *Oklahoma Gas & Electric Co.*

Transformer loading of 140% not economical if costs to overcome voltage drop is more than cost of installing larger transformers. Loading as high as 100% on radial secondary systems not economical for densities of 10 kva or less per 1000 ft. Loadings of 85% and up on banked and radial secondaries most economical at higher load density. Bank secondaries indicated at densities of 18 to 40 kva per 100 ft as economical flicker control method.

Detection of Overheated Transmission Line Joints By Means of a Bolometer. J. R. Leslie and J. R. Wait, *The Hydro-Electric Power Commission of Ontario.*

Infra-red bolometer developed by Germans during war to trace ships in English Channel by heat radiation applied to detection of overheated conductor joints on transmission lines. Device highly portable, easily set up. Temperature can be measured within 5 C if joint more than 10 C above ambient.

Hy-Therm—An Improved Overhead-Line Conductor. L. F. Hickernell, A. A. Jones, C. J. Snyder *Anaconda Wire and Cable Co.*

Describes a new copper alloy for overhead conductors having 15 to 20% higher current rating than commercial brands. Higher carrying capacity due to increased resistance to annealing. Properties give longer useful life under load; no significant loss of conductivity.

Disagreement with certain of the premises of Bryce Brady's paper on Distribution Transformer and Secondary Conductor Economics was voiced by several discussers. T. J. Brosnan, Buffalo, Niagara Electric Co, observed that the conclusions differ with those of other economic studies. Differences he felt might be traced to Brady's assumption of uniform secondary loading, which might seriously distort results particularly at loadings of around 5 kva per 1,000 ft. Chase Hutchinson, Ebasco Services, also questioned Brady's premises. He felt that a more realistic (larger) tolerance for non-cyclic flicker voltage might have been assumed than the 4-v value used.

H. E. Campbell, General Electric, saw in the Brady paper a demonstration of the advantages of banked secondaries. He warned, however, that the diversity between customers should not be overlooked in banking secondaries. He commented also that anticipated load growth and the cost of changing transformers will effect the selection of the most economical transformer size. Such considerations may make larger transformers economical.

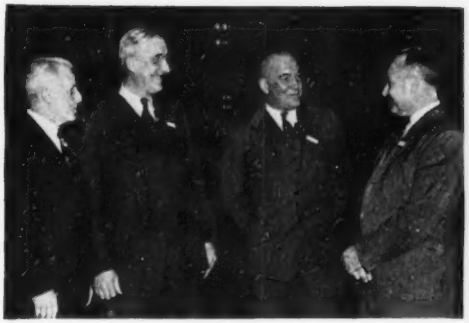
Discussion of the Hickernell, Jones, Snyder paper drew from Prof E. C. Starr of Oregon State College a question regarding the effect of higher conductor current ratings upon power loss economies. Leonard Olmstead, Duquesne Light Co, called attention to dangers from reduced clearances due to expansion at emergency short-time current ratings of 760 amp. He questioned ability to make permanent joints and splices at these emergency ratings.

In absentee discussion of the Leslie-Waite paper, A. A. Osipovitch, Bonneville Power Administration, pointed to the need for data on wind velocity in connection with temperature readings on conductor joints made with the Bolometer. Prof E. C. Starr, Oregon State College, and others questioned the necessity for determining joint resistance from temperature measured by Bolometer. They suggested comparison of joint and conductor temperatures as a means of determining allowable temperature rise. A. S. Runciman, Shawinigan Water & Power Co, reported use of an a-c Bolometer Bridge device on a Canadian 220-kv transmission line. L. S. Custers, National Research Council of Canada, reported that tests on three types of similar devices showed points of merit for the a-c Bolometer Bridge over the radiation chopper type Bolometer described by the authors.

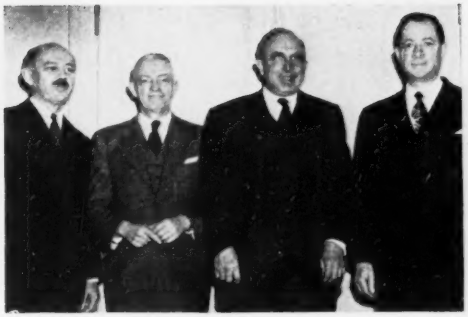
INSULATED CONDUCTORS

High-Pressure Gas-Filled Cable Impregnated With Extra-High Viscosity Oil. Joseph Sticher and G. H. Doan, *Detroit Edison Company*, R. W. Atkinson and Louis Meyerhoff, *General Cable Corp.*

Mass impregnation of paper cable insulation with high viscosity oil undertaken in manufacture of 120-kv high-pressure gas-filled cable. Tests show that sudden cable temperature drops do reduce ionization starting potential due to viscose oil blocking gas channels producing low gas pres-



E. J. Amberg, Conn. Light & Power; E. K. Huntington, Rochester G. & E.; J. J. Bennett, Western Mass.; L. J. Audlin, Central N. Y. Pwr



O. E. Eckert, Comm., Lansing, Mich.; J. R. Ketchel, Jersey Central P. & L.; R. C. Roe, Burns and Roe; F. L. Lovett, Rockland L. & P.

sure regions. However, minimum ionization potential is still 65% above that for 138-kv operation. Sudden repeated releases of gas pressure at infrequent intervals have no harmful effects.

The Thermal Movement Of Moisture In Soil. A. S. Mickley, *Philadelphia Electric Co.*

A theory of moisture movement in soils under thermal gradients confirms published text data. A formula is developed that determines moisture movement quantitatively and permits precise evaluation of effect on underground cable heating.

The Temperature Rise Of Buried Cables And Pipes. J. H. Neher, *Philadelphia Electric Co.*

Paper confirms accuracy of Kennelly formulas in calculating temperature rise of cable buried in earth. Shows that objections to Kennelly's method lie in evaluation of thermal resistivity of earth. Finds laboratory determinations do not represent conditions in practical installations but that spherical test radiator offers practical method of determining effective thermal resistivity.

Generally favorable comments on all formal papers marked discussion at Friday morning's session on Insulated Conductors. G. B. Shanklin, General Electric Co, observed that only experience will show whether the advantages of mass impregnation of cable insulation with high viscosity oil, described by Sticher, Dean and associates, justify the manufacturing difficulties. He called attention to the lack of self-healing properties in the high viscosity oil used. The wider margin between ionization starting potential and normal operating voltage inherent with high pressure cable was fortunate in view of this characteristic of the high viscosity oil used, Shanklin said.

K. S. Wyatt, Phelps Dodge Copper Products Co reported difficulties with oil referred to by Sticher. When bombarded in an ionization cell, chlorides separated out resulting in the formation of hydrochloric acid and deterioration of power factor. More recent batches of oil have been less troublesome in this regard. Wyatt warned also that voids will form in high-pressure gas-filled cable insulation due to non-symmetrical distortion of insulation under gas pressure. Loss of oil from this voids would be disastrous, he warned.

E. J. Merrell, Phelps Dodge Copper Products Co presented data from tests on mass impregnated round and oval type high pressure gas-filled cables. The test cables were subjected to 30 two-day load cycles; 24 hrs on and 24 hrs off. Ionization factor immediately after removal of gas pressure was measured as 0.01%. It increased to 2.2% in five days.

A new technique in the manufacture of soldered porcelain potheads was described in a conference paper by A. E. Papp and J. H. Nicholas, G & W Electric Speciality Co. Metal parts of the pothead are soldered directly to metalized porcelain to eliminate gasketed assemblies. The soldered joint between metal and porcelain consists of three bonds in series.

Although lauding elimination of gaskets, L. I. Komives, Detroit Edison felt that the construction puts too much reliance on dexterity of the workman. Difference in expansion coefficients of porcelain and metal, he felt, might cause the metal parts to pull away from the porcelain.

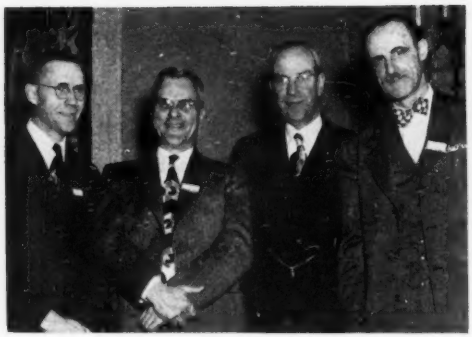
ELECTRICAL TESTS ON DIELECTRICS IN THE FIELD

Two conference sessions were devoted to the practices developed for determining the condition of insulation in service; one group was confirmed to d-c tests and the other to a-c.

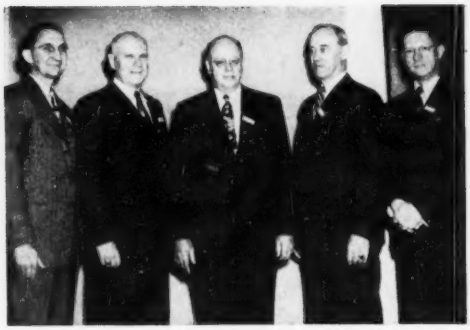
The low-voltage segment was treated by E. B. Curdts of J. G. Biddle Co in terms of instrumentation and power sources for testing in the field.

F. C. Doble, of Doble Engineering, reviewed the history of prong testing of insulators on a potential distribution basis. In the discussion there seemed to be considerable agreement that high voltage field d-c tests are not readily made and correlate best with a-c tests when the insulation is in comparatively poor condition. R. F. Fields of General Radio, however, expressed the belief that true insulation resistance can be correlated with power factor readings; he favored ample time (e.g., 15 or 20 min) for stabilization of the charging current.

Results of the 20-year use of the Doble test method by the American Gas & Electric system were reported by I. W. Gross. The program was prompted by an epidemic of high voltage bushing failures. Early tests disclosed fault bushings which failed in a few days before they could be replaced; d-c tests had detected a smaller percentage. The system now has seven mobile sets working all the time. Gross said the value in terms of dielectric life and reliability is at least three times the cost of the testing. Commonwealth Edison has always advocated high voltage testing said A. L. Brownlee, because it gives greater assurance of exposing incipient failure. He showed why power factor alone is a deceptive index unless the voltage is high enough to inject ionization.



J. B. McClure, General Electric; N. N. Smeloff, Penn. Power & Light; F. D. Knight and C. L. Derrick, Hartford Electric Light



W. H. Osterle, West Penn; A. G. Dewars, No. States; F. S. Brown, Duquesne Lgt.; G. S. Humphrey, Potomac Ed.; B. M. Jones, Duq. Lgt.

EDUCATION

Both Mr. K. B. McEachron, Jr. of G. E. Co and J. C. McKeon of Westinghouse stressed the need for training in good citizenship along with advanced technical training sponsored by industry. Mr. McKeon defined professional development as that which combines a good engineer with a good citizen and referred to the need for continued education to prevent a "post college slump".

Each speaker felt that the first three to five years in industry represented a pre-professional period or internship. During this period they said it is highly important that the community and professional societies contribute to his training. Other development programs should include broad-minded supervision; planning job for the man rather than man for job; continued technical education; promotion of professional activities; encouragement and recognition; guidance and counciling; and courses in economics, human relations and public speaking.

RELAYS

Protection of Stations without High-Voltage Switching. Project Committee, Relay Committee.

Replies summarized for 169 installations without local breaker or fuse. Reclosing systems not generally found. General opinion from most companies would indicate that stations without h-v switching can be operated and protected successfully.

Shipshaw Relay Protection. J. T. Madill and F. H. Duffy, *Aluminum Co of Canada, Ltd.*

An outline of generator-transformer-circuit breaker-transmission-line unit protection in a hydroelectric station. Split-phase protection for the generator is the high-speed, 1-cycle type.

Electronic Relay Developments. James J. Loving, *Airborne Instruments Laboratory, Inc.*

Development work outlined in application of impluse forming circuit, fault-type detector circuit, impluse and tripping circuits, and including direction, distance and time delay elements.

Economics of low-voltage switching of transmission is here to stay, is a view of H. P. Sleeper, P. S. E. & G. Co. He gave an opinion that relay schemes should eliminate time delay, switches should drop in one cycle, and schemes should be designed to fail safe. G. B. Dodds, Duquesne Light Co, stated that remote tripping is being used if the bank is less important, grounded disconnects go in if the bank is important, and there is a trend to important banks.

On sensitive ground protection, according to E. T. B. Gross, Chairman of Project (relay) committee, it is evident that extensive development will be necessary to clarify further possibilities of "arc frequency relaying."

BACK-UP PROTECTION

On back-up protection, a proposed definition is—"for the purpose of insuring against failure of the primary relaying to operate". This wording was given by W. L. Ridenhour, Pennsylvania Water & Power Co. In addition he gave a list of items for evaluation back-up protections.

Protection experiences on 132-kv system were related by L. W. Marts, Public Service Electric and Gas Co, and some points were advanced for solution.

Transmission line back-up protection for a ring bus system with multiple power sources was explained by H. W. Haberl, Quebec Hydro-Electric Commission. In some localities use is made of a number of gas detector relays with accumulator and diaphragm elements, and other relays are omitted.

SWITCHGEAR

A Manually Operated Spring Mechanism for Medium Voltage Oilless Circuit Breakers. *B. W. Wyman and E. J. Casey, both General Electric.*

Manually compressed spring accelerates rotating mass which closes contacts fast enough to obviate prestrike arc.

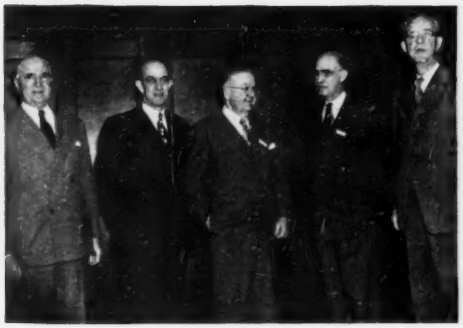
A New 69-Kv Compressed Air Circuit Breaker. B. P. Baker and E. Frisch, *Westinghouse Electric.*

Orifice-type, 2½ million-kva, 2,000-amp. Enclosure carries bushings leading to bus. Has interrupted 37,500 amp with 44 kv across a single pole.

Notable progress continues in circuit-breakers design and operation. Manual reclosing for remote locations has its place, but as an expedient. It was suggested that a 6-volt automobile storage battery starter might be useful in reclosing. Twenty-cycle reclosing is acceptable and 3-cycle opening an attainable objective. Portable tank lifters are of increasing importance as breakers are transferred to new locations.

High cost of switchgear galleries and load growth in New York City have led Consolidated Edison to establish 69-kv. transmission to certain load centers. Air-blast breakers of 3,500,000 kva interrupting capacity are used. Circuit breaker design is faced by the necessity for further field experience with contrasting types. Problems of inspection and maintenance increasingly influence development. Discussers differed as to the future preponderance of oil-

R. C. Ericson, Northern Indiana Public Service Co; H. H. Henline, Secretary AIEE; W. R. Smith, Public Service Electric & Gas Co



William Arthur, Allis-Chalmers; Frank W. Cramer, Carnegie Illinois; R. T. Stafford, J. B. Hodtum, and R. S. Fleshiem, Allis-Chalmers

blast over impulse type and air-blast breakers. Stress was laid upon the importance of space and mass reduction and the use of resistors in parallel with series and shunt orifices.

LIGHTNING AND CORONA

Advances in Technique of Lightning Measurements. Theodore Brownlee, *General Electric*.

Improved measuring equipment and techniques that contributed to accuracy of lightning records in 4-year study on a rural distribution system. Mentioned are: Special shunts that match expected lightning currents to sensitivity of oscillographs; method of initiating oscillographs to get maximum accuracy; and improvements that increased accuracy and speed of magnetic link calibrations.

Transmission Line Design and Performance Based on Direct Lightning Strokes. E. L. Harder and J. M. Clayton, *Westinghouse Electric*.

Complete set of curves is developed for estimating transmission line insulation and performance is presented based on concept of lightning stroke current as a constant fixed current rather than as a constant voltage back of a stroke surge impedance. Curves utilize latest stroke current probability data.

Radio Influences From High-Voltage Corona. Gordon R. Slemon, *The Hydro-Electric Power Commission of Ontario*.

Study shows radio noise from corona on smooth conductors is produced only during negative peak of voltage wave when negative wave exceeds corona threshold voltage. Radio noise from corona on conductors with negative potential can be controlled by a smooth coating of high work function that prevents electron emission. Rough surface with low work function facilitates emission: reduces corona current pulses.

Lightning Investigation On A Rural Distribution System D. D. MacCarthy and D. A. Stann, *General Electric*, D. R. Edge, *Graybar Electric Co*, and W. C. McKinley, *Central Electric Cooperative*.

Analysis of comprehensive lightning investigation on 7,200-v multigrounded rural system reveals that nearly one-third of lightning surges reached distribution transformers by secondary or pole ground wires; two-thirds of surges reached system phase and neutral wires through same channels. Half of arrester surge currents were at least 200 amp; 67% at least 100 amp.

Interest in the as-yet undefined relationships among radio-interference, corona and transmission line losses was the universal expression of those discussing the Slemon paper on radio interference from corona.

H. L. Rorden, Bonneville Power Administration, had experienced, in practice, the reduction in radio noise noted by Slemon when phase spacing is reduced. Rorden also observed that visible corona increased as spacing was cut and noise reduced. "What, then," he asked, "is the relation between corona, noise and losses?" Prof. E. C. Starr, Oregon State College, asked the same question.

F. Cahen, who is associated with the 400-kv transmission experiments near Paris, foresaw that radio disturbances may well outweigh losses as a factor influencing line design limitations in the future. Commenting on the use of semi-conducting rubber coatings for conductors to reduce corona and radio noise, Victor Siegfried, American Steel & Wire Co, warned that too high a resistance in the coating might result in an increase in the apparent corona loss due to charging current.

The Harder-Clayton paper on transmission line design and performance based on direct lighting strokes drew generous discussion.

E. R. Whitehead, Illinois Institute of Technology, saw in it a convergence of opinion toward lightning stroke current as the fundamental quantity on which to base design calculations. He said it was not until comparatively recently that sufficient data was available regarding lightning current expectancy to form a basis for usage.

P. L. Bellashi noted that the paper's ratio of tower to mid-span flashover for 230 kv seemed high. He traced this to the use of a 2 x 40 microsecond current wave which he felt might have too steep a front. Coupling factor between phase and ground conductors was another contributing factor that he suspected. H. L. Rorden, Bonneville Power Administration, and others sought information on what happens when lightning hits conductors in mid span. As yet he observed, no mid-span strokes to conductors have been experienced on the BPA system.

CARRIER CURRENT

Line Tuning Equipment Used with Coaxial Cable for Carrier Current Installation on Power Lines. H. J. Sutton, *Gulf States Utilities*.

Analysis preceding application to Beaumont-Baton Rouge 132-kv line. Coaxials up to 230 ft.

Microwave Channels for Power System Application. AIEE Carrier Current Committee.

One channel (e.g. 952-960 mc) affords up to 60 times as many signal-channels as power line carrier for telemetering, supervisory, relaying, voice, transfer tripping, teletype, telegraph and load control.

Increasing installations of high voltage cables for city getaways prompted a symposium group of papers reporting test data concerning attenuation of carrier superposed on them. Complex losses are comparable to those of low impedance cables (e.g., eight miles of 138-kv oil-pipe), said C. S. Murray of Consolidated

L. R. Gaty, Philadelphia Electric Co; W. N. Johnson and L. F. Hunt, both of Southern California Edison Co, Ltd

Bryce Brady, Oklahoma G.&E.; L. M. Olmsted, Duquesne Light; W. R. Brownlee, Commonwealth & Southern; A. A. Johnson, Westinghouse

Edison. Oil pressure pipe-type cable gives roughly twice the attenuation of oil-filled at 60 and 100 kc.

T. A. Cramer of General Electric showed the following ranges in decibels per mile for oil pipe-type cable when tested from 50 to 150 kc: 1,000 MCM 120 kv, 1.25 to 2.75; 350 MCM 138 kv, 2.2 to 4; 1500 MCM 138 kv, 2.6 to 6.2; and 69 kv, 3.0 to 5.4 decibels per mile.

Data for a composite 132-kv line (Northwest Station to Waukegan) 37 miles embracing 5.8 miles of 600 MCM paper-and-oil lead-covered cable. Worse than the cable segment —from the carrier standpoint—is the high-loss return path introduced by the sheath-bonding transformers. Overall loss of 52.3 decibels was reported by H. A. Cornelius (Public Service of No. Ill.) and B. W. Storer (Commonwealth Edison).

WATTHOUR METERS

Surge Protection in a Modern Watthour Meter. F. H. Busch and G. D. Williams, *both General Electric.*

Use of high-coercive Alnico V for the brake magnets and Cunico for the suspension magnets along with eddy-current shields and insulation coordination afford the I-50 meter surge protection.

A New Thermal Volt-Ampere Demand Meter. M. E. Douglass and W. H. Morong, *both General Electric.*

Bimetallic springs in paralleled circuits with temperature-sensitive resistor gives voltage compensation over range of voltage (216 to 264 shown).

A New Type Instrument for Measuring Air Velocity. C. E. Hastings, *Hastings Instrument Co.*

Moving air reduces d-c differential voltage from a-c heated thermopile; useful for checking motor self-ventilation.

An Electro-Optical Shutter for Photographic Purposes. A. M. Zarem, *Stanford Research Institute*, F. R. Marshall and F. L. Poole, both *U. S. Naval Ordnance Test Station.*

Kerr cell, no moving parts, affords exposure time of four ten-millionths of a second.

Comment was offered by F. C. Holtz (Sangamo) on the Busch-Williams paper that demagnetization of brake magnets for stabilization is not new and that copper plating has been an effective means of preventing subsequent demagnetization. He had heard no instances of failure in this respect due to short circuits or lightning in over nine years. Use of gaps for impulse relief has also been the practice and the authors admitted that the gaps could hardly be expected to guard against inordinate fault currents.

The device described by Robison in a conference paper was explained and developed primarily for testing station meters. It compares the speed with that of a reference meter by means of a *cathode-ray* tube and photocell. The standard meter controls the sweep circuit and the tested meter. The amplitude degree of discrepancy is found by correcting the applied voltage by a known percentage.

D-C MACHINERY

Development of a Small Integral Horsepower D-C Motor. Lanier Greer and J. A. Clark, *Reliance Electric and Engineering Co.*

Design of a basic motor to meet as many ratings as possible with one set of mechanical parts for economy in manufacture. Method discussed gives consideration to selection of electrical windings and physical dimensions of the various parts, using frame size NEMA284 as an example.

Solid Short Circuit of D-C Motors and Generators. T. M. Linville and H. C. Ward, Jr, *General Electric.*

Formulas for determining current are derived in terms of constant impedance, similar for synchronous machines. For this result in advantage is that any number of d-c machines may be included in a network.

Oscillographing Commutation. M. J. Baldwin, *General Electric.*

Cathode-ray oscillograph pictures show effect of variation in the adjustment of the commutating pole and of mutual inductance upon the rate of change of current. Theoretical theory of commutation is proved to be correct.

Commutation of D-C Machines and Its Effect on Radio Influence Voltage Generation. D. P. Motter, *General Electric.*

Tests made on dynamotor armature. Radio influence voltage generation is at a minimum while using standard brushes and where interpoles are not employed; laminated brushes can improve linearity of armature coil current reversal.

Effects of Commutator Surface Film Conditions on Commutation. C. Lynn and H. M. Elsey, *Westinghouse Electric.*

Some out-of-the-ordinary problems are: Copper picking by brushes, copper oxide thickness, humidification minimum; use of hydrogen sulphide, chlorine, hydrogen atmosphere, silicone vapor; brush design and treatment; conditions studied to provide satisfactory operation.

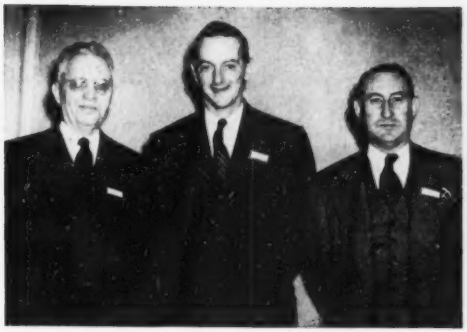
Electrical Noise at the Sliding Contact. V. P. Hessler, *University of Illinois*, M. C. Cottom, *University of Kansas.*

By the various tests, carbon ring is superior to a copper ring but not suitable for continuous operation; for quietness, avoid metal graphite brushes on copper ring; electrographitic brush operating on silver slip-ring was most satisfactory arrangement.

Measuring Commutation With an Indicating Instrument. R. T. Lundy, *General Electric.*

Electronic voltmeter is connected directly across the brushes; advantages are elimination of variation in readings due to different observers and shows sparking on all the brushes with one reading.

For underground mining service, F. R. Terrant and Lanier Geer, Reliance Electric and Engineering Co, explained during this conference



L. W. Smith, Doble Engineering Co; F. H. Duffy, Aluminum Co of Canada Ltd; J. A. Rawls, Virginia Electric & Power Company

E. E. Dreese, Ohio State; R. M. Kalb, Minneapolis· Frank Smith, Sargent & Lundy; E Hansson, Penn. W.&P.; E. M. Strong, Cornell

meeting that the flat, consequent or induced-pole construction makes possible a motor of low height.

Transient interpole inductance of d-c machines was reported on by F. M. Scott, Allis-Chalmers Mfg Co. He also told about the application of large interpole inductive shunts for reversing motors 4,000 to 7,000 hp.

Both cumulative and differential series fields have been installed in d-c motors for parallel operation, according to A. W. Kimball, Westinghouse. Shunt characteristic for overall performance is preserved in a six-motor sectional printing press drive.

The design of d-c motors for use in automatic control systems requires a study to determine the motor constants which affect system performance, according to Paul Lebenbaum, General Electric Co. The motor time constant is one of several constants. An equation has been developed which shows that the minimum possible motor time constant is fundamentally a function of the armature diameter to length ratio.

CHEMICAL, ELECTROCHEMICAL, AND ELECTROTHERMAL PROCESS

Distribution and power wiring problems vary widely in different parts of the country and necessitate different engineering solutions, F. R. Benedict, presiding chairman, pointed out in opening this conference session. B. J. Nankervis, Dow Chemical Co, said that basically for two Texas plants they use an aerial cable system at 15 kv for more than 200,000 kw.

L. W. Roush, Carbide and Carbon Chemicals Corp obtains safe operation in chemical plants with inflamable and explosive vapors by (1) sealing electrical material so corrosive or explosive gases cannot reach vital points (2) making and breaking all electrical contacts under oil. Except for special cases, explosion-proof housings are not satisfactory.

W. N. Livermore, E. I. du Pont de Nemours & Co, said they have installed much underground cable using oil base compound with a Neoprene bearing sheath. Cable is more expensive than paper insulated cable, but it is easier to terminate reliably, and to make taps and splices.

W. H. Dickinson, Standard Oil Development Co, said that since 1939 the use of electricity per barrel of crude oil has increased from 2¾ to 3½ kwhr. Electrical loads in refineries comprise: Process units, 30-45%; product loading and unloading, 15-25%; water pumping, 15-25%; and office, warehouses, etc, 10-20%.

W. J. O'Meara, Atlantic Refining Co, reported that their Point Breeze Refinery near Philadelphia buys power on basis of 87% load factor and 98% power factor. Their own power plant takes the peaks.

W. T. Thagard, Texas Eastern Transmission Corp, said that one billion kwhr annually will be used to transport 500 million cu ft of natural gas per day through the former "Big Inch" and "Little Inch" oil lines. Operation for the line depends entirely on purchased electrical energy.

J. R. Horacek, Diamond Alkali Co, discussed the electrical installation for their new Pasadena, Texas, plant. (See ELECTRICAL WORLD, Dec 18, 1948, p 83 and Jan 29, 1949, p. 146.)

INDUSTRIAL CONTROL

Air Core Reactors Used to Raise the Fault Capacity of Existing Motor Starting Equipment. T. W. Haymes, Jr, *Shell Oil Co.*

As plants expand, available short circuit kva at terminals of motor starters may exceed interrupting capacity of existing starters. For plant discussed, best of five solutions was use of air core reactors in each motor starting cubicle.

The Use of Air-Core Reactors As Fault Limiting Means on High Interrupting Capacity Controllers. John D. Leitch, *Electric Controller & Mfg Co.*

Design relationships. For 2,300-v 60-cycle systems, air core reactors are relatively small and lightweight for use with motors up to 600 hp. For 440 and 550 v, desirable application ranges up to 200 hp; for 220 v, up to 100 hp.

Wound Rotor Induction Motors for Synchronized Drives. E. L. Schwarz-Kast, *University of Chicago.*

Results of two tests using pair of standard wound rotor motors for both main drives and Selsyn-motors without additional transmitters or receivers. Where applicable this simplified Selsyn is simple and inexpensive.

Some Fundamentals of D-C Controlled Reactors With Resistive Load, H. F. Storm, *General Electric.*

Amplification factors from 100 to 10,000 for a single stage can be obtained from d-c controlled reactors using ordinary transformer core materials.

Discussion of air-core reactors brought out that: (1) reactors in individual motor branch circuits can limit a source of infinite power to 25,000 kva, thus interrupter is independent of growth of plant load or supply capacity; (2) reduced voltage starting is obtained automatically without contactors; (3) care must be used in applications needing high starting torque, such as ball-mills or crushers; (4) temperature-rise is no problem; (5) for dielectric strength, glass insulation is used, and (6) if

R. B. Chase and F. C. Gardner, both of Electric Bond and Share Company

A. J. Cooper, Chairman Smoker Committee, and K. W. Reece, Ebasco

S. J. Rosch, Anaconda and L. W. Roush, Carbide & Carbon Chemical Corp

with 60 cycle power, interruption occurs within first half cycle the total rms current interrupted can be as high as 150% the rms value of the a-c component.

Net of the discussion was that caution should be used in applying wound rotor motors for synchronized power drives. G. W. Heumann, General Electric, said loads should have low inertia and high friction, such as for gantry cranes. Several drives in service using 15 to 40 hp motors. The drive should not be used for either overhauling or shock loads.

ELECTROSTATIC PRECIPITATION

Electrically Charged Dust In Rooms. G. W. Penney, *Carnegie Institute of Technology*, G. W. Hewitt, *Westinghouse Electric*.

Dirt accumulations result from space charge potential created by inefficient electrostatic precipitators. For large auditoriums and especially dirty locations, an additional electrode can neutralize this potential with particles of opposite charge.

Two conference papers covering applications and characteristics of power supplies for electrostatic precipitation, and a third dealing with electrostatic painting, were presented along with paper by G. W. Penney, Carnegie Institute of Technology, and G. W. Hewitt, Westinghouse Electric.

As reported by D. W. Hawkins, General Electric, Kenotron tubes for supplying high d-c potential have several advantages over mechanical rectifiers.

Characteristics of power supplies for electrostatic precipitors were discussed by W. F. Strong, General Electric. Electronic and mechanical power supplies predominate in applications covering industrial gases, air conditioning, liquid precipitation and

H. R. Paxson, Philadelphia Electric and L. W. Clark, Detroit Edison Company

deposition, orientation and separation. Strong advised that various forms of control in either primary or secondary circuit can decrease or prevent arc-over shutdowns.

E. P. Miller of Harper J. Ransburg Co presented examples of electrostatic painting in various fields.

FLUORESCENT LIGHTING

No one can prophesy the future progress of fluorescent lighting except to say it will be great. This is the net of conference talks by W. C. Brown, General Electric, R. G. Slauer, Sylvania, and Marshall Waterman, Westinghouse. The three discussors presented an integrated picture of, respectively, development of fluorescent sources, of economics of their application, and of trends in the ways of their use. Although improvements will undoubtedly be made in production of light by incandescence, the possible efficiency of this source is limited by the method itself. No such limitation exists on the fluorescent lamp which today turns about one-third of its electricity input into light and has possibilities of much higher efficiency.

The fluorescent lamp has freed the lighting art from the "candle" status, providing light sources capable of applications previously impossible. This is because of the vast range of color values, sizes and shapes, and light emissivity.

CONTROL OF ELECTRIC HAZARDS IN RURAL AREAS

That farm wiring should be safe when installed and should be kept safe by periodic re-inspection was the argument of the papers, "Electrical Hazards to Farm Stock," and, "Rural Neutral Potentials," respectively by W. B. Buchanan and J. H. Waghorne, both of the Hydro-Electric Power Commission of Ontario. A large number of cases in Ontario of cattle killed by electric shock in their stalls in 1943 were investigated. Resulting from this the Commission embarked on a continuous study of grounding and other conditions on distribution systems that might be contributory to such effects. Nearly all fatalities to stock resulted from sustained faults to metallic enclosures on consumers' equipment.

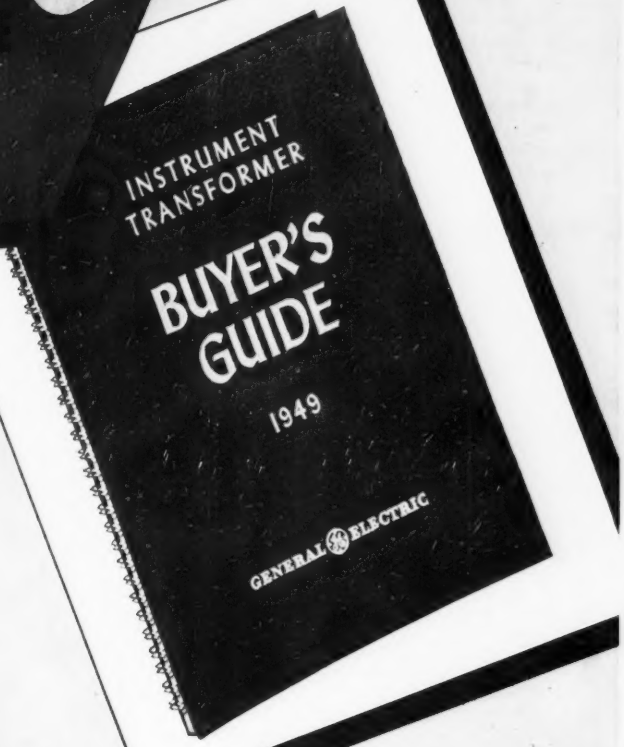
A lucid exposition of the fundamentals of protective grounding on wiring was presented by A. H. Schirmer, Bell Telephone Laboratories.

American farmers are buying 400,000 electric fence controllers per year, said Charles F. Dalziel, University of California.

latest information on

INSTRUMENT TRANSFORMERS

in the NEW 80-PAGE BOOKLET



FOR your convenience General Electric has just published a new Buyer's Guide on instrument transformers. This is a sequel to earlier guides which have proved so popular in the past. It contains up-to-date information on 107 types of G-E instrument transformers for both indoor and outdoor use.

In addition to the clear, detailed illustrations on each page, you will find information on prices, ratings, and ASA accuracy classifications. All this has been combined to provide you with a handy digest of G-E Standard Transformers.

References are provided on each page to help you order supplementary bulletins containing more technical descriptions. These are free, as is the Buyer's Guide itself. Fill in coupon to get yours now. *Apparatus Dept., General Electric, Schenectady 5, N. Y.*

CLIP AND MAIL THIS COUPON TODAY

YES I need a copy of the new "Buyer's Guide" (GEA-4626) to help me in the selection of instrument transformers.

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GENERAL ELECTRIC

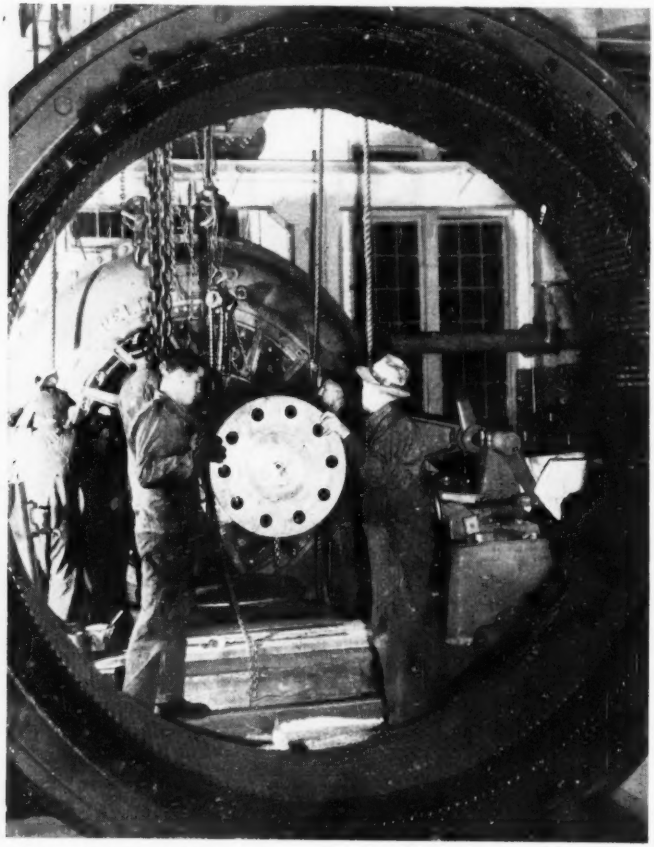
HOW TO DESIGN • CONSTRUCT OPERATE • MAINTAIN

Convert A-C Motors to Generators

THREE synchronous motors and hydraulic turbines which once drove d-c generators have added 2,800 kw of a-c generation to the Washington Water Power System. The machines were made available by conversion to alternating current of all d-c distribution in Spokane.

J. S. McNAIR
Superintendent
Production Plant Maintenance and Construction
Washington Water Power Co
Spokane, Wash.

For many years Spokane's 250-v d-c street lighting was supplied from two sources—water-wheel-driven generators and synchronous-motor-driven generators. With the recent changeover to alternating current, these units were no longer needed for d-c generation. Because of increased a-c loads and a critical need for a-c generating capacity, it was decided to utilize the capacity of the three water wheels.



CONVERTED A-C MOTOR is driven by this hydraulic turbine to generate alternating current. Turbine and motor once powered d-c generators which were discarded when Washington Water Power Co completed conversion of all d-c distribution

The d-c units were removed and the synchronous machines were installed on the turbine shafts. As the motors were rated 4,000 v, 3 phase, 360 rpm, a minor adjustment had to be made on the turbine governor to raise the speed from 350 to 360 rpm. The motors now operate as synchronous generators, using the original source of field excitation. The station operator regulates voltage manually by the field rheostat. Transformers are not required since the units generate power at 4,000 v, the station bus voltage.

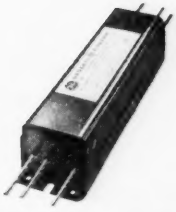
Although the three turbines were not designed for this new speed and capacity, they have been successfully converted to provide a combined output of 2,800 kw.

Gin Handles Energized 13.8–Kv Conductors

A "WIRE GIN" for handling conductors energized at potentials up to 13,800 v has been perfected by W. D. Blackmon, line foreman for South Carolina Power Co.

The gin is made of oak reinforced with iron braces. It comprises an arm about three feet long pitched at about a 45 deg angle. The lower end and an A-brace in the middle have clamps attached. A small block and pulley is attached to the arm from which a rope handles the wire.

When changing wires from one pole to another, or raising them to a higher cross-arm, the "Blackmon Arm" is clamped to the crosspiece on



Keep an eye out for this tag when you're in the market for fluorescents. It means the fixture is equipped with a General Electric ballast—the industry's finest. It is *your* assurance of rated lamp life and maximum light output, of quiet and trouble-free operation.

All G-E ballasts are designed, built and tested for permanent lamp-matched characteristics. They get the most out of standard fluorescent lamps—give you the quality and economy you are looking for in fluorescent lighting. *Apparatus Department, General Electric Company, Schenectady 5, N. Y.*

FLUORESCENT LAMPS do not draw current directly from the lighting circuit as do incandescent lamps. Instead, they are operated by a transformer or ballast—especially and carefully designed for the purpose. With fluorescent lighting, therefore, the amount of light you get from the lamps, the life of the lamp, and to some extent the life and efficiency of the fixture itself, depend to a large measure upon the characteristics of the ballast. Good ballasts mean better, more economical lighting.

GENERAL ELECTRIC

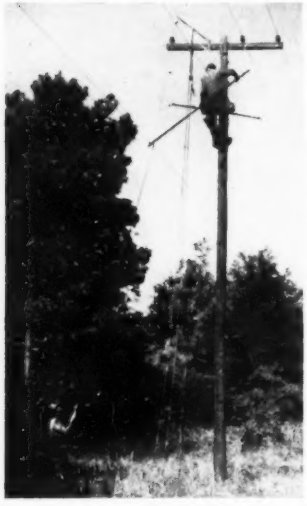
412-459

top of the taller pole. A hook on the block and pulley is lowered to the line and the wire is caught by linemen on the ground, who operate the dry rope to raise the energized line.

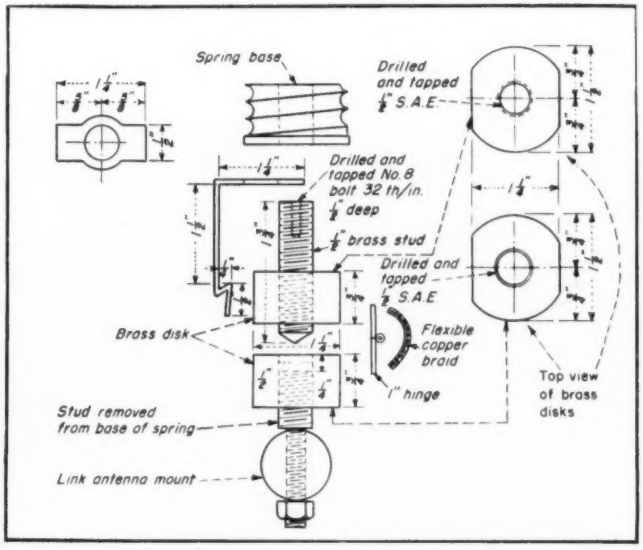
The rope is kept in a "hot stick" box so that it never comes in contact with the ground.

The method can be used for changing insulators with safety and ease. Tests made on work in Beaufort County have proved the efficiency of the device.

WIRE GIN used by South Carolina Power Co for handling conductors energized up to 13.8 kv permits wires and insulators to be changed with safety and efficiency



BLACKMON ARM being used to handle energized lines. "Hot sticks" help guide and place the lines, which are raised with dry rope handled by the ground crew


Spring base
Drilled and tapped ½" S.A.E.
Drilled and tapped No. 8 bolt 32 th/in. ½" deep
½" brass stud
Drilled and tapped ½ S.A.E.
Brass disk
Flexible copper braid
1" hinge
Top view of brass disks
Stud removed from base of spring
Link antenna mount

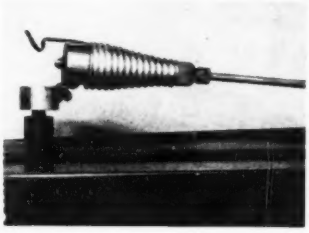
DETAILS of hinged antenna base which preserves the advantages of the spring mount while the antenna is erect but allows it to be swung to horizontal position without injuring the spring

Developed Hinged Base for Mobile Unit Antennas

E. L. MILLER
Radio Dept
The Ohio Power Co
Belaire, Ohio

BEFORE radio-equipped cars and trucks are put in the garage, their whip antennas are frequently tied down to protect them. However, this practice has caused considerable damage to the spring at the base of the antenna and has often made replacement necessary. Weakening of the spring may cause side sway of the antenna, which could be detrimental to pedestrians or vehicular traffic, or could lead to breakage of the spring and possible loss of the antenna.

Since replacement of these springs is expensive, the customary spring mount has been modified as illustrated to provide a hinged base which may be opened to allow the antenna to lie in a horizontal plane with the spring in an undistorted position. The base consists of two brass disks which are flattened on diametrically opposite sides and joined on one side by an iron hinge and flexible copper-braid shunt brazed to them. The hinged base is normally held closed by a $\frac{1}{2}$ x $\frac{1}{16}$-in. (thick) spring-steel snap-catch which fits over the brass stud in the upper disk and is clamped to the latter by screwing the antenna-spring base on the stud. The snap-catch hooks under the lower disk.



HINGED antenna base in open position

The stud attaching the lower disk to the fixed antenna mount is the one which formerly held the antenna-spring base to the mount. However, its head now has been cut off. The pointed end of the stud in the upper disk will extend into the hole in the lower disk and serve as a centering pin when the hinged base is closed. The threads have been removed from the upper part of this hole. The tapped hole in the top of the upper stud is for attaching the spring shunt which is joined to the antenna base.

Your own records will show what we've done about lightning

In the middle of 1943 our engineers made discoveries about impulse strength which led to changes in design of small, low- and medium-voltage distribution transformers. What these changes accomplished can be seen in *your* records.

If your experience is typical, roughly half of all distribution transformer failures can be charged to lightning. However—if your records are typical—on all Spirakore transformers delivered since late 1943, lightning failures have been almost insignificant.

One of Many Spirakore Advantages

Important as this increased impulse strength is, it is still only one of the advantages you get with General Electric distribution transformers. You get Spirakore design throughout the entire line of single-phase liquid-filled transformers—with its great savings in size and weight. You get improved clamping construction for greater mechanical strength. You get sealed tanks for longer oil life. You even get a new, better, synthetic-resin baked-on paint which improves appearance and reduces maintenance.

Spirakore Still Leads

Today—as ten years ago when lighter, smaller Spirakore transformers made history—Spirakore still leads the field—the finest distribution transformer we have ever made, the finest you can buy. Ask for Bulletins GEA-4885 and GEA-4521. *Apparatus Dept., General Electric Company, Schenectady 5, N. Y.*

GENERAL ELECTRIC

Home-Made Temperature Cabinet Finds Many Uses

A 1,000-w electric space heater and the refrigeration system from a household refrigerator are the heating and cooling units, respectively, of a home-made temperature cabinet that has found many uses around the instrument and standards laboratory of the Cleveland Electric Illuminating Co.

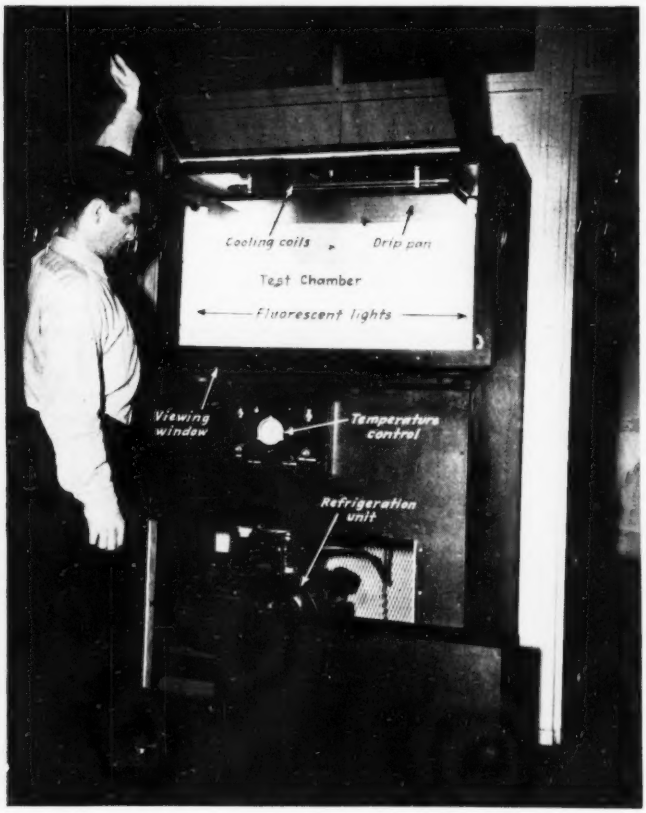
The cabinet, shown, provides a range of pre-set, thermostatically controlled temperatures from 32 to 158 F in steps of 2 deg. The unit was originally built to be used for making periodic temperature compensation tests on field and laboratory instruments and standards that are required to give precise indications under a variety of temperature conditions. Gradually its use has been extended to include such things as acceptance tests for the history records of new portable instruments, as well as constant temperature tests on some of the smaller items of electrical equipment, such as motors and the like.

Mineral Wool Used

The unit, which is 5 ft 8 in high, 4 ft wide and 3 ft deep, overall, is enclosed in Masonite and insulated with mineral wool. Its test chamber, which has a volume of about nine cu ft, has walls of sheet steel. Cooling coils of the refrigeration unit are suspended from the ceiling while the electric heater is housed in a grill on the floor. A drip pan is located beneath the coils to collect falling condensate. The temperature control panel is located below the viewing window.

Any combination of a-c or d-c supply that is available within the laboratory can be brought into the test compartment through a system of plugs, jacks and jumpers provided therein. Light within the test chamber is provided by two 30-w fluorescent lamps which are mounted on the side walls.

Access to the chamber is through a double glass door that is shown raised. A second double-glass viewing window is provided in the front of the cabinet for convenience in reading instruments during tests. This window is inclined slightly from the horizontal.



TEMPERATURE CABINET, made from 1,000-w heater and home refrigeration unit, provides automatically controlled temperatures from 32 to 158 F for making temperature compensation checks on field and laboratory instruments and standards used for precise measurements. Constant temperature tests may also be made on small motors and the like

Crossarm Redesign Stops Pole-Top Bending

H. I. TAYLOR
Structural Engineer
Portland General Electric Co
Portland, Ore.

Portland General Electric Co has redesigned wishbone crossarm construction to balance physical loading and eliminate objectionable bending of wooden poles. The new design equalizes opposing bending moments at the top of high voltage transmission line poles. A bending condition which has become increasingly serious on older lines will thus be avoided.

Unbalanced Moments

In the original design, moments of the two conductors on one side of the pole were about 85% greater than the single conductor on the other. This unbalanced torque caused a definite bend toward the heavy side. In some cases the pole top was moved over a foot or more and guying was required to prevent further deformation.

Clockwise and counterclockwise moments were made equal in the new

(Continued on page 114)

when you don't need indication

THIS IS THE CUTOUT TO USE—

It saves you money!

This G-E non-indicating fuse cutout is the lowest in price of all wet-process-porcelain enclosed types. It costs less to maintain—with practically no moving parts. It is the sturdiest cutout built. You can stock fewer replacements—all contacts, fuse holders and other parts have been interchangeable for 21 years.

Backed up by an unexcelled operating record of performance efficiency, and durability, this cutout is the most reliable and economical type you can buy.

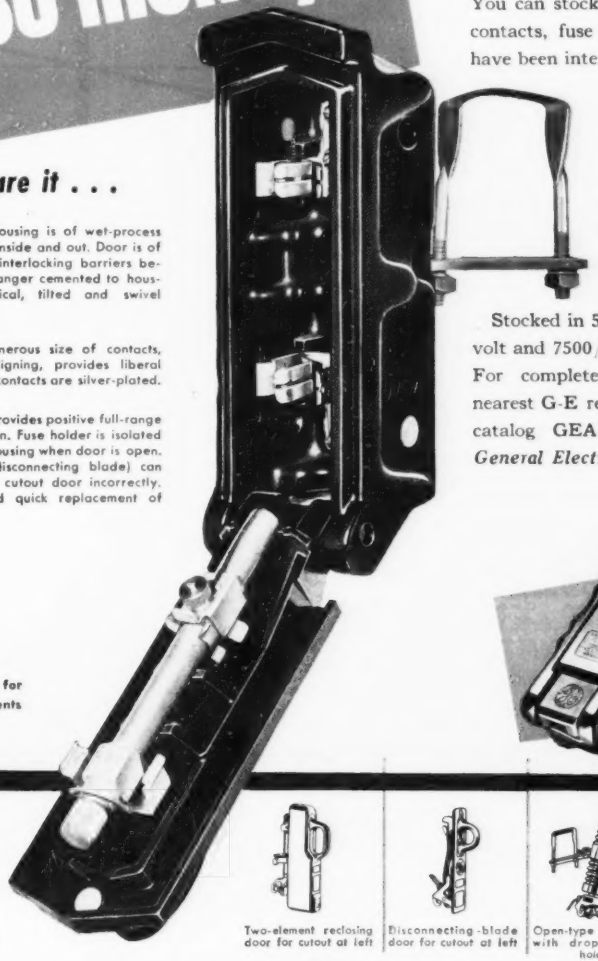
Stocked in 50- and 100-ampere, 5000-volt and 7500/12,500-volt Gr. Y ratings. For complete information, see your nearest G-E representative or write for catalog GEA-2390. *Apparatus Dept., General Electric, Schenectady 5, N. Y.*

Compare it . . .

MECHANICALLY—Housing is of wet-process porcelain glazed inside and out. Door is of Textolite. Double interlocking barriers between contacts. Hanger cemented to housing permits vertical, tilted and swivel positioning.

ELECTRICALLY—Generous size of contacts, which are self-aligning, provides liberal contact area. All contacts are silver-plated.

FUNCTIONALLY—Provides positive full-range current interruption. Fuse holder is isolated from contacts in housing when door is open. Fuse holder (or disconnecting blade) can not be placed in cutout door incorrectly. Enables easy and quick replacement of blown fuse.



Primary Fuse Cutouts for All Service Requirements

Enclosed indicating and drop-out fuse cutout

Two-element reclosing door for cutout at left

Disconnecting-blade door for cutout at left

Open-type fuse cutout with drop-out fuse holder

Flip-open fuse cutout

GENERAL ELECTRIC

406-28

A Guide for Wood Pole Spacing and Setting

Data are presented for areas served, conductor sizes and terrain and are based on Standard Specifications for Overhead Line Construction by Detroit Edison Co

A—SPACING OF POLES

1. GENERAL.

(a) For economy, the longest uniform spans consistent with the conditions to be met should be used.

(b) Where street lighting is present or expected, spans are limited by the desired spacing of lamps.

(c) In areas with scattered load, intermediate poles may be omitted for temporary economy and added later as needed.

2. SUBDIVIDED AREAS. Spans should be limited to those which best fit the lot line spacing and provide for reaching all services conveniently. Where a future layout has been prepared by the Planning Division it shall be followed, except where field conditions make it inadvisable to do so; in such cases the estimator shall request change in layout from Planning Division. These general rules apply:

(a) Lots 50 ft or less in width—spans normally 120 to 150 ft

(b) Lots over 50 ft in width—spans normally 150 ft or more, according to type of construction. With No. 2 weatherproof copper secondaries, maximum span 250 ft; for spans longer than 250 ft use rural line construction.

3. UNSUBDIVIDED AREAS. Spans shall be limited by:

(a) Number of Circuits. Where there are more than three circuits (for example more than one transmission, one primary and one telephone or street circuit), the spans shall be not over 175 ft unless approved by the Engineering Division.

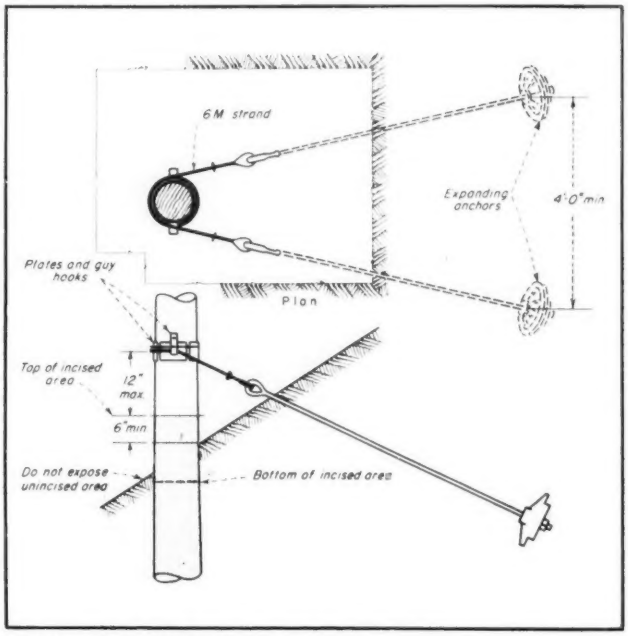
(b) Strength of Poles. Side wind loading on wires and pole will not exceed allowable load on standard stock sizes of poles.

4. SPAN LIMITS by conductors are shown in table.

Pole Span Limits by Conductor Sizes (wp includes wpx and tree wire)

Conductor Size, Awg	Line Design, Ft	Individual Span, Ft	Max Av of any two adjacent spans, Ft
COPPER			
8 duplex	150	200[a]	
8 bare, hard	175	180	
8 wp, hard	150	180[b]	
8A	360	400	385
6 bare, hard	225	245	235
6 wp, hard	175	180	178
6A	400	450	425
4 bare, hard	275	300	290
4A	450	500	475
2 wp, hard	250	250	...
1/0 bare, hard	300	350	325
1/0 wp, hard	250	300	275
4/0 bare, hard	350	400	375
4/0 wp, hard	300	350	330
ACSR			
4	300	350	330
2	400	450	425
1/0, 2/0, 3/0, 4/0	300	400[c]	350
	400	500[d]	450

[a] Sag for 900-lb heavy loading
[b] Sag for 625-lb heavy loading
[c] 24/40 kv
[d] 4,800 v



ANCHOR ARRANGEMENTS for cedar pole butt on steep slope

Rake on Self-Sustained Deadend Poles

Height of Pole or Stub, Ft	Rake, In.	
	Western Cedar	Southern Pine
30	9	9
35	11	10
40	15	12
45	18	16
50	22	...
55	24	...

B—SETTING OF POLES

1. DEPTH OF SETTING. Poles shall be set to the depth specified in wood pole constants tables. Deeper settings may be specified for foundation strength.

On steep slopes or along ditches, the standard setting depth shall be with reference to the lowest ground within two ft of the pole. If this rule calls for top of the incised butt treatment of a cedar pole to be closer than 6 in. to ground, use a full length cresoted pole. When a full length cresoted pole is not available, use construction shown in illustration.

2. RAKING. All 22-ft or 25-ft wood stubs and steel stubs shall be set with a rake of approximately 18 in. unless otherwise ordered. Longer stubs, poles used as stubs, and poles at flexible deadends should be raked only enough so that they will be practically vertical when normal loading (at stringing tension) is applied.

Amount of rake on self-sustained deadend poles to be used ordinarily are shown in the table. The values may be varied to suit field conditions.

This is General Electric's new secondary capacitor—3-kvar, 240-volts, single-phase—for pole mounting. It is approximately 40 per cent lower in price per kvar than similarly rated secondary capacitors heretofore available.

NEW! low-cost secondary capacitor

opens new fields in kvar generation

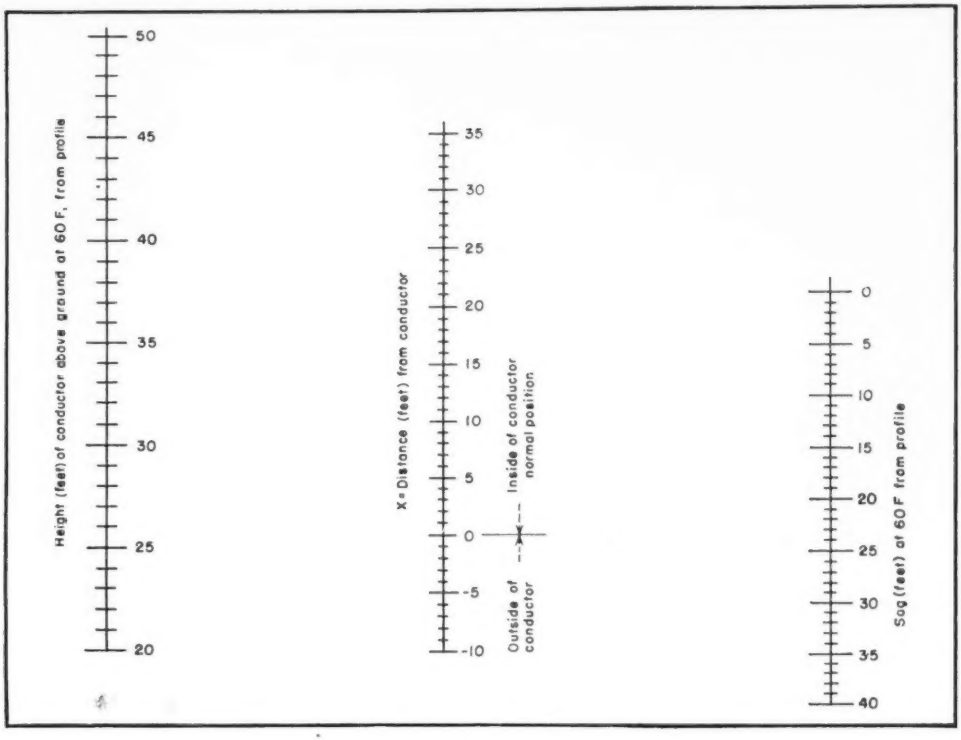
Secondary capacitors give the same benefits as primary capacitors for all the system, back to the generators, and in addition they decrease the voltage drop in the transformers and the secondary runs. Secondary capacitors will allow you to have more customers on each feeder, or existing customers can increase their load by 20 to 50 per cent for the same allowable voltage limits between the first and last customer with existing transformers.

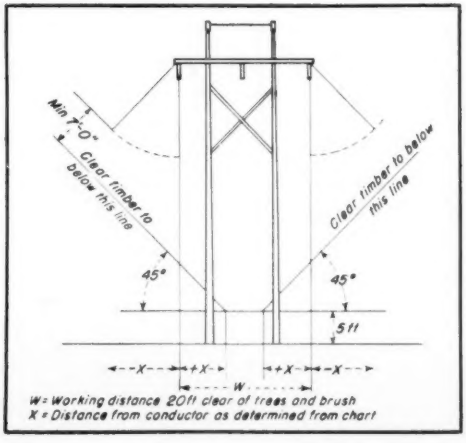
Look into this new secondary capacitor for those load areas where either voltage drop or distribution transformer capacity is a problem. In many cases, it has proved most economical. We'd like to go over our calculations with you. Get in touch with your G-E representative, or write direct to *Apparatus Sales Divisions, General Electric Co., Pittsfield, Mass.*

GENERAL ELECTRIC

Tree Clearance Chart for 66-Kv Line

J. L. MEYERS, Transmission Line Engineer, Omaha Public Power District, Omaha, Neb.





ACCOMPANYING NOMOGRAM and outline are aids for determining where trees should be trimmed or felled along the route of a 66-kv line on H-frame structures.

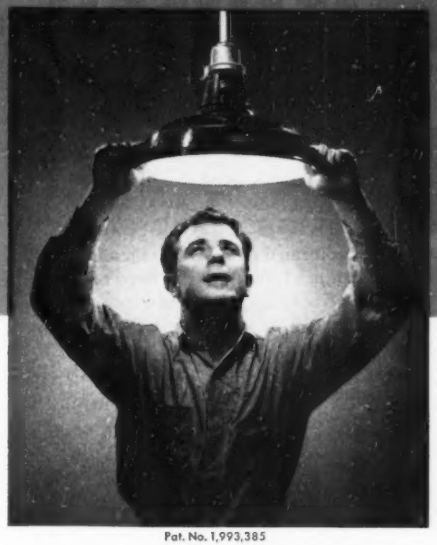
Trees at or near the H-frame structure and those where the ground clearance is great will be saved. Result is a saving of both trees (from owner's or lessee's standpoint) and labor (from utility organization's standpoint).

Instructions: Place straight edge on scales for "height of conductor" and "sag," and on middle scale read "distance from conductor." This point indicates where the observer stands to determine the danger timber on a 15-deg line of sight at eye level.

Note: The greater the conductor sag, the lower the tree clearance line. Trees on side slopes are to be treated as special problem.

TIMBER CLEARANCE LINE based on conductor height and sag

APPLETON DISKONECT REFLECTORS



Pat. No. 1,993,385

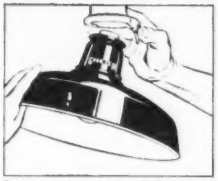
the most practical DETACHABLE REFLECTORS *ever made!*

Here's Appleton's answer to the ever-present problem of installing and servicing light reflectors quickly and easily. The Diskonect Reflector is attached or detached from the hood instantly by means of a snap lock—without twisting, tugging, forcing or the use of tools. The heavy drawn-steel hood is fitted with a spring-set lever which locks or unlocks the porcelain enameled reflector.

Even when the Diskonect Reflector remains in place for extended periods, detachment remains quick and easy. Corrosion and "freezing" together of component parts are prevented by metal-to-glass connection—heavy, rustless cadmium plate to porcelain enamel.

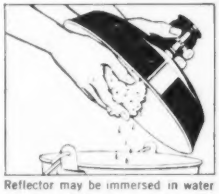
Diskonect Reflectors are finished in permanent porcelain enamel and offered in a wide variety of styles. Complete "come-apart" construction permits cleansing of all parts separately a time-saving feature that enables you to maintain a higher standard of lighting efficiency.

5 SIMPLE STEPS FOR EASIER SERVICING

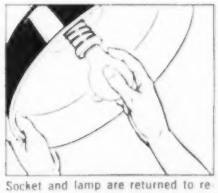


Release spring-set lever. Reflector and lamp are detached instantly, as a unit.

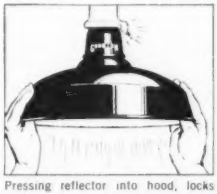
Lamp and socket are removed together. Slight upward pressure and a quarter turn remove them from reflector.



Reflector may be immersed in water for thorough cleaning to restore original reflecting surfaces.



Socket and lamp are returned to reflector and securely locked with merely a simple twist of the wrist.



Pressing reflector into hood, locks reflector in place, lights lamp, again delivers full illuminating efficiency.

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APPLETON

CONDUIT FITTINGS • LIGHTING EQUIPMENT • OUTLET AND SWITCH BOXES • EXPLOSION-PROOF FITTINGS • REELITES

NOW! Armoring...

1 ARMORING MADE EASY

with Locke Preformed Armor Rods on corner post installation. Here linemen have taken strands in bunch and placed across conductor. Note how rods have been pre-twisted by machines at factory to fit conductor. Time-consuming process of rod-twisting formerly done by linemen is eliminated.

2 NOW LINEMEN TWIST

strands around conductor from center toward ends. They twist in opposite directions, keeping ends free. As twisting progresses outward, strands easily and quickly "snap" into position. No wrench or other installation tools required.

3 ONE FINAL TWIST

and corner post armoring installation has been completed . . . in matter of seconds! No clips, clamps, special tools or skill has been required. Yet rods grip conductor like vise every inch of their length. Have your linemen try them . . . with free full-size samples we'll gladly supply. Mail coupon at right today.

before you buy... **stop!** see what LOCKE's got...

in 3 Simple Steps!

— You Save Time, Trouble, Money

with LOCKE PREFORMED armor rods!

SAVE TIME—Because they're pre-twisted at factory, Locke PREFORMED Armor Rods "snap" onto your conductors by hand . . . don't have to be twisted on with tools—don't need clips or clamps to *keep* them on. Linemen simply lay strands across conductor—twist—and the job is done . . . in seconds!

SAVE TROUBLE—"No clips, no clamps, no special tools!" Locke PREFORMED Armor Rods make nighttime and cold weather installations easy—there are no small parts to worry about—no complicated operations to go through. The hoist goes up the pole just once—carrying *only* the PREFORMED Armor Rods!

SAVE MONEY—Besides giving you *more* trouble-free installations per man-hour, Locke PREFORMED Armor Rods cut your costs by cutting your losses. *Re-usable* because they're permanently formed of tough, springy metals* . . . they also give *better conductor protection* because they grip tighter, cover completely. This means no chafing, no abrasion, no slippage . . . less corrosion at support points!

**Locke Preformed Armor Rods are available for every size and kind of conductor . . . come in aluminum alloy, galvanized steel, copper and bronze.*

"Always see your locke distributor first"

55 Years' Experience in Hardware and Insulators

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NAME.....

TITLE.....

COMPANY.....

ADDRESS.....

Please Indicate Conductor Size and Kind

before you buy.. stop! see what LOCKE'S got...

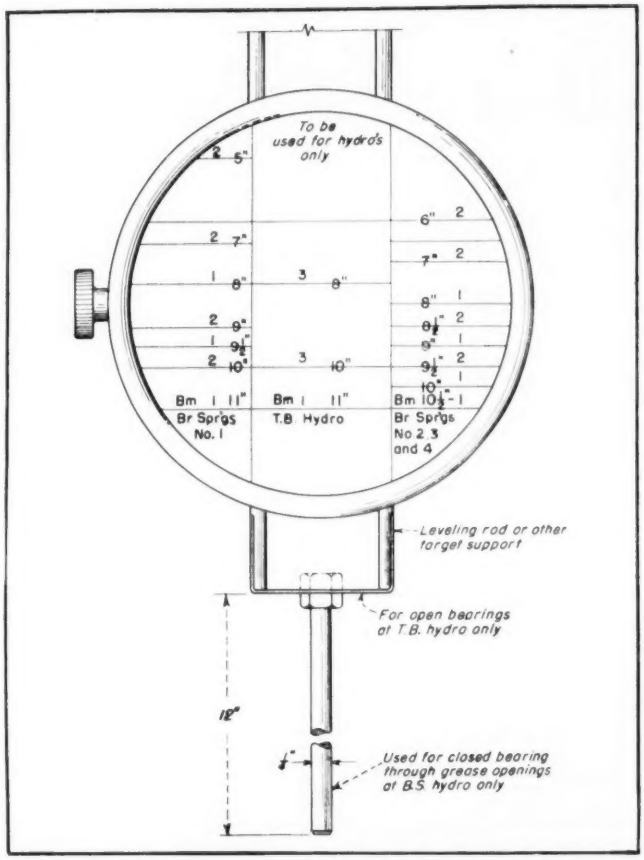
Crossarm Redesign Stops Pole-Top Bending

(Continued from page 106)

design. Lever arms for the two conductors on one side of the pole total the same as the single lever arm on the opposite side. The net result is a cancellation of all moments. The top of the pole is subject to no unbalanced torque and will not be deformed.

REDESIGN of wishbone arms balances bending moments about the top of the pole. Moment arm of the single insulator is equal to the sum of the moment arms of the two insulators on the opposite side

POLE-TOP DEFLECTIONS of a foot or more on this Portland General Electric line have resulted from unbalanced physical load of conductors. Redesign of the wishbone construction is expected to prevent the same condition on new construction


To be used for hydro's only
Bm 1 11"
Br Sprgs No. 1
Bm 1 11"
T.B Hydro
Bm 10½" 1
Br Sprgs No 2 3 and 4
Leveling rod or other target support
For open bearings at T.B. hydro only
12"
Used for closed bearing through grease openings at B.S. hydro only

TARGET used to level waterwheel shafts. Use of three separate scales has the advantage of indicating the successive diameters of the shaft on each unit so that they do not have to be measured before observing level. Separate scales also simplify the method of indicating number of reading positions on each shaft (numeral next to shaft size)

Leveling Target for Horizontal Waterwheel Shafts

H. O. SCHNABEL
Twin Branch Plant
Production Dept
Indiana & Michigan Electric Co
Mishawaka, Ind.

Once each year the waterwheels of our hydroelectric plants are taken out of service for inspection and general overhaul. At this time the horizontal waterwheel shafts are checked and the bearings adjusted to keep the shaft centers aligned in a horizontal plane. When using conventional level-and-rod methods, it was necessary before each bearing reading to refer to a drawing, ascertain shaft diameter and compute correct elevation. This required considerable time and introduced the chance of error.

To expedite the checking and adjustment of alignment, a special leveling target (illustrated) was designed which indicates directly (without calculations) when any bearing of any waterwheel at the Twin Branch or Berrien Springs hydro plants is at the correct elevation. Three scales are provided: The left one is for Berrien Springs unit No. 1; the right scale

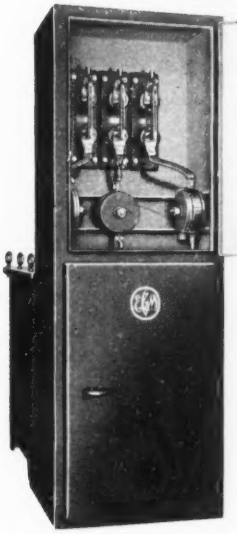
2300-4600 VOLT MOTOR SHORT CIRCUIT PROTECTION SIMPLIFIED

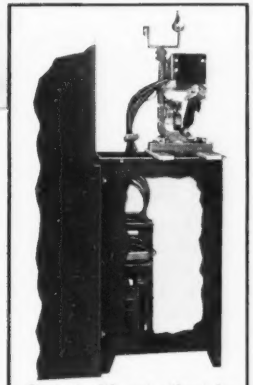
UNLIMITED PROTECTION AT ONE COST

EC&M VALIMITOR* STARTERS

1. Eliminate calculation of available KVA.
2. Prevent future revisions as KVA grows.
3. Reduce effect of "short" clear back to the power source.
4. Give *permanent* protection—no future changes, nothing to replace after a fault.
5. Permit standardized starters suited for circuit of *any* power capability.

*Trade Mark (Volt-Ampere-Limitor).





Contactor lifts out without disconnecting any leads or bolts.

Short circuit protection that is constant and does not change with the times is an important feature of EC&M VALIMITOR Motor Starter for 2300-4600 volt motor drives.

Instead of a starter built to suit existing KVA requirements, EC&M VALIMITOR Starters may be connected to a bus of any capacity. These new starters are designed to limit fault currents from a bus of *infinite* capacity to 25,000 KVA (steady state current). The heavy duty contactor of 50,000 KVA interrupting capacity clears such faults quickly.

EC&M VALIMITOR Starters also improve starting conditions. Lower inrush current and a smoother start may save the cost of the more expensive reduced voltage starter. When the motor is up to speed, these starters function like any standard full voltage starter.

Send only name-plate data of your motors for complete information on EC&M VALIMITOR Starters.

MAXIMUM RATINGS		
Squirrel-cage, Synchronous or Wound-Rotor Motors		
2300 Volts		4600 Volts
600 HP 300 HP	60 Cycles 25 Cycles	600 HP 250 HP

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NEW PERFECTION POST HOLE DIGGER

DURABLE:
Blade and shank forged in one piece from a bar of steel. Heat treated for maximum toughness. Handles, extra strong select ash. Top section shaped for easy hand grip. Blades attached with hardened steel bolts.

EFFICIENT:
Balance is perfect. Properly distributed weight drives sharpened blades easily into any soil. Blades hold edge because of tough heat-treated steel.

TOP VALUE:
Unexcelled because of construction and efficiency. Manufactured by The American Fork and Hoe Company, Cleveland, O., Makers of True Temper Products.

STURDETOOLS
A TRUE TEMPER PRODUCT

Perfection Post Hole Digger No. 445. Heavy duty model. Forged steel heat-treated blades 12" by 7" in size. 11 gauge weight, sharpened edges. Select ash handles, 8 ft. long, smooth, sanded and lacquered. Address inquiries to distributor.

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for Berrien Springs units No. 2, 3 and 4; and the middle scale for Twin Branch hydro units. The inch figures refer to shaft diameters and the adjacent figures indicate the number of reading positions on each size shaft.

When used on the Twin Branch units, which have open-type bearings, the leveling rod used to support the special target is set directly on the shaft (i.e., without the ¼-in. extension rod). For the Berrien Springs units, which have closed-type bearings, the extension rod is attached to the lower end of the leveling rod (as shown) and inserted in the grease hole to allow reading directly on the shaft.

Application of Special Target

Since each generator is powered by several twin waterwheels whose shaft centers must be kept at the same elevation, readings are taken on the top side of each successive shaft at its bearings, starting with the largest shaft next to the generator, immediately outside the building wall. This point is accepted as the bench mark (BM), or basis for relative elevations, since the running clearance of the generators is maintained through routine maintenance check ups.

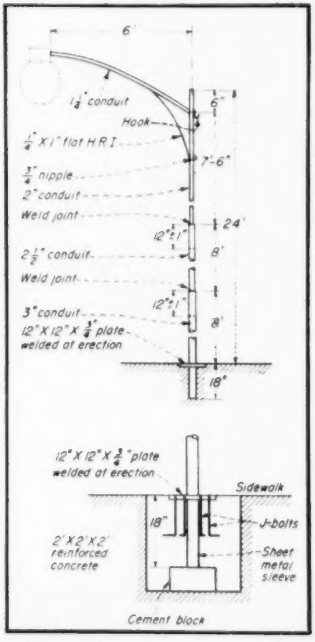
Surveyor's level is set up at a position permitting all bearings on a shaft to be sighted merely by rotating the level. Surveyor's leveling rod is then set on the BM shaft and the target adjusted until its line marked BM is level with the horizontal cross-hair of the level. The target is then clamped to the rod in this position and kept there until all other readings on that shaft have been taken. At each successive bearing the target rod is set up on the shaft while a workman adjusts the bearing until the target line labeled with the shaft size is brought to the cross-hair elevation of the level.

Observations

This method of leveling is practicable only where relative levels of the same points have to be regularly checked or adjusted and requires that the target scale be designed for the bench marks and reading positions involved. A conventional leveling rod is not necessary: the special target can be attached to any support. With this type of target, levels can be run accurately and quickly by a less-experienced man for several reasons: (1) No readings of blue prints or verniers are required; (2) no computations are necessary so possibilities of arithmetical error are eliminated and considerable time is saved; (3) greater accuracy is achieved since for each reading the instrument man is concerned with only one easily identified line on the special target and does not have to read the conventional graduated scale on a leveling rod; (4) accuracy of reading depends on how carefully the lines were drawn on the target; (5) all that is required of the instrument man is that he know how to operate a level.

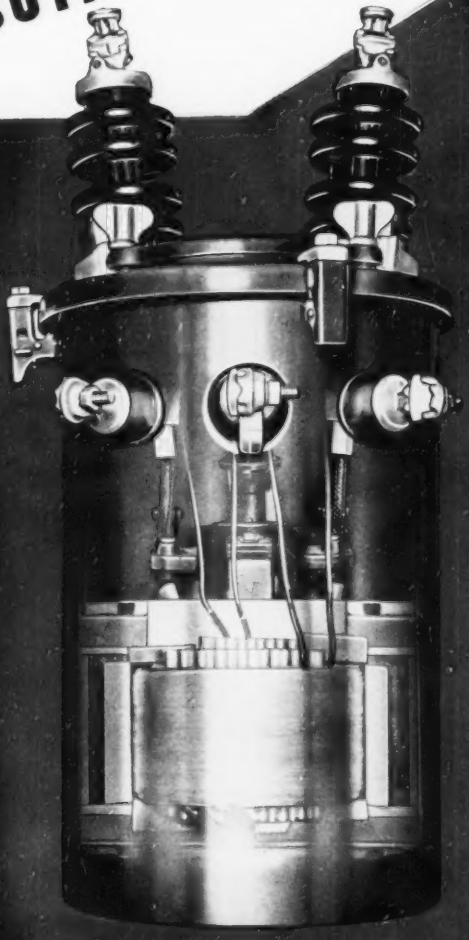
Fabricated Standards Save Time and Money

STREET LIGHTING standards fabricated locally of conduit saved Kirkland, Wash., more than a year in installing modern street lighting. With the completion date fixed by a local festival, deliveries of 55 weeks quoted on standards were out of the question. Needham Electric, a local electrical contractor, was awarded the



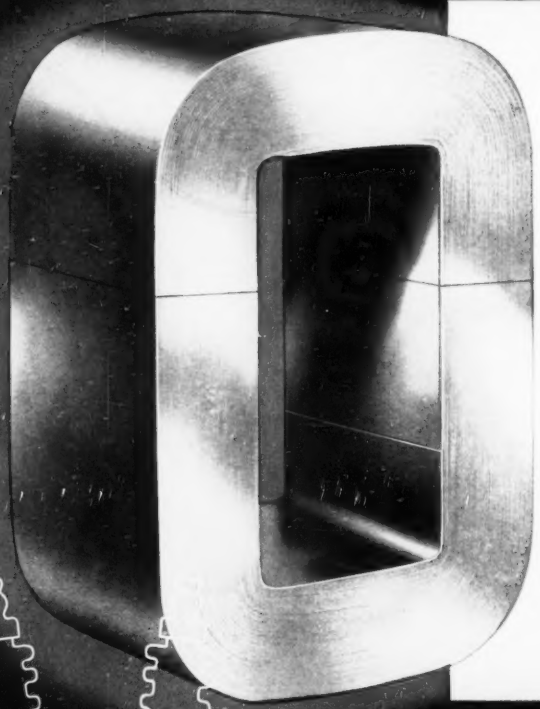
DESIGN DETAILS showing welded joints, conduit bracket, brace, hook for transformer, and method of anchoring

Announcing—
THE NEW MOLONEY HiperCore³
DISTRIBUTION TRANSFORMERS



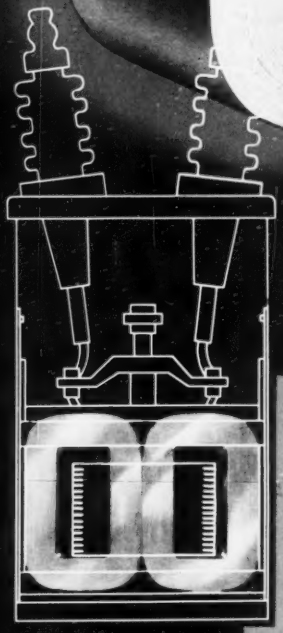
*CORES MADE OF HIGH PERMEABILITY, ORIENTED, SILICON STEEL

THE *NEW* MOLONEY



The new Moloney HiperCore Distribution Transformers incorporate advanced engineering practices and simplicity of construction, plus the usual Moloney high factor of safety in design. Cores are wound of high permeability, oriented, silicon steel having 30% to 35% greater flux carrying capacity than hot rolled steel. This makes it possible to decrease the amount of steel, copper and other materials, and at the same time improve the operating characteristics.

HiperCore Transformers with wound cores, are lighter in weight and smaller in size than transformers having cores of non-oriented steel. They have greater short-time overload capacity and provide better voltage regulation. Simple construction, together with low winding temperature gradient, results in trouble-free operation and longer life under all loading conditions. HiperCore Transformers are made in sizes 50Kva and smaller, in voltage classes 15 Kv and below. Available in both Conventional and CSP Type of single-phase transformer.



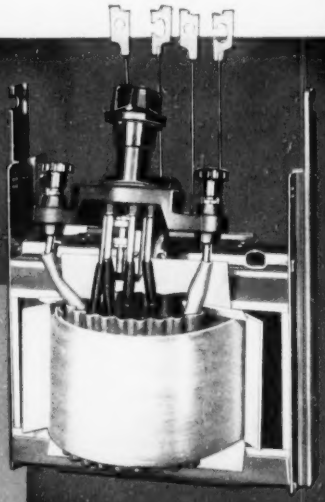


Illustration at left shows how cores and coils are assembled. After cores are wound, they are annealed, impregnated and then cut into pairs of U-shaped pieces. Two large U-shaped pieces are placed side by side, forming an inner and two outer core legs. Then the windings are placed over the inner core leg. Next, the two matching U-shaped pieces are placed into position to complete the magnetic circuits. A thermo-setting adhesive bonds the core faces together. Steel bands are used to obtain tight joints. Complete core-and-coil unit at right.

HiperCore®

*CORES MADE OF HIGH PERMEABILITY, ORIENTED, SILICON STEEL

DISTRIBUTION TRANSFORMERS

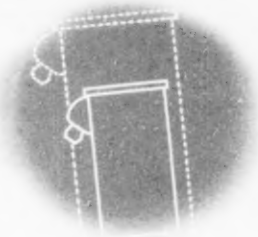
4 STAR FEATURES

1

LIGHTER WEIGHT

The 30% to 35% higher flux carrying capacity of the oriented core steel used in HiperCore Transformers makes possible the use of smaller cores and windings, with consequent reductions in the weights of steel, copper, oil, and other materials. HiperCore Transformers weigh 15% to 30% less than transformers having cores made of hot rolled steel, making them easier to handle and install.

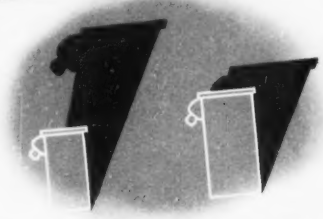
2



SMALLER SIZE

Since the higher flux carrying capacity of oriented steel permits the use of smaller cores and windings, smaller tanks can be used. Reductions in size range up to 30%. HiperCore Transformers take up less space on the pole, in the storeroom, and on the line truck.

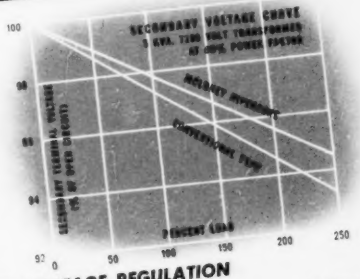
3



GREATER SHORT-TIME OVERLOAD CAPACITY

Moloney HiperCore Transformers have improved short-time overload characteristics which provide better peak load performance and longer life. Reduced coil mass, achieved through use of oriented steel cores, together with the extensive use of cooling ducts, results in more rapid cooling of the windings and in a lower hottest-spot temperature gradient.

4



BETTER VOLTAGE REGULATION

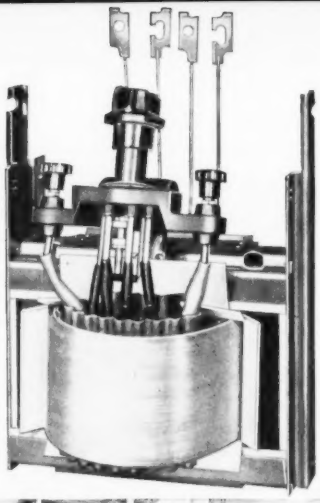
The smaller cores of HiperCore Transformers make possible windings having lower impedance. Lower impedance provides lower internal voltage drop at all loads. This is especially important during peak load periods, since HiperCore Transformers can carry higher overloads than older types, at the same permissible regulation.

MOLONEY ELECTRIC CO.

Power and Distribution Transformers Exclusively Since 1896

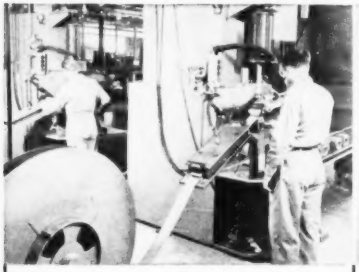
FACTORIES AT ST. LOUIS 20, MISSOURI AND TORONTO, ONTARIO, CANADA

MOLONEY *HiperCore** DISTRIBUTION TRANSFORMERS

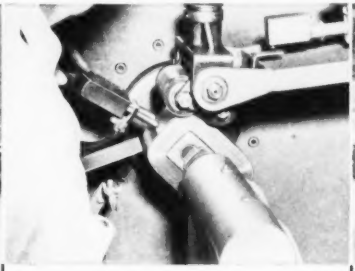


HiperCore Transformers are made in a new building designed especially for their production. Entirely new equipment, much of which is highly specialized, has been installed for the manufacture of these new transformers. Some of this equipment is pictured below in illustrations of some of the steps in the fabrication of the cores for HiperCore Transformers.

*CORES MADE OF HIGH PERMEABILITY, ORIENTED, SILICON STEEL

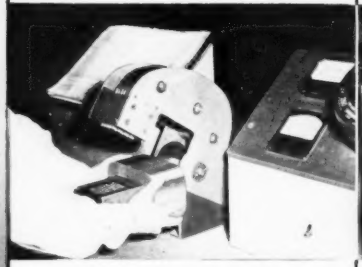


Core steel is received in wide rolls and is cut into desired widths on a slitting machine. Cores are then wound on semi-automatic winding machines such as those pictured above.

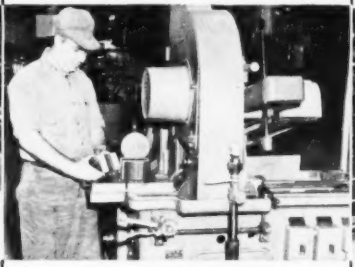


Winding machines stop automatically when desired core thickness has been reached. Steel is cut and the end is spot-welded as shown in the photograph. Core is then ready for annealing.

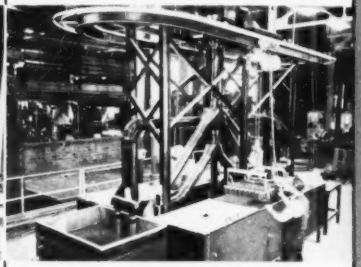
Wound cores are annealed in bell-type annealing ovens in a nitrogen atmosphere. Photo shows inner bell being lowered into position over a charge of cores. Outer bell containing heating elements is then placed over inner bell.



Following annealing, the winding mandrels are pressed from cores and then cores are tested. Wound core is placed over lower section of the split test coil, following which, coil is closed and core loss read on meter.



After satisfactorily passing loss test, cores are vacuum impregnated and baked. Following this operation, the cores are cut into U-shaped sections on the abrasive cutting machine shown above.



The cutting operation leaves ends of laminations slightly burred. Faces of the U-shaped core pieces are de-burred by an etching process to restore proper loss characteristics. Cores are then ready for assembling with transformer windings.

MOLONEY ELECTRIC COMPANY

FACTORIES AT SAINT LOUIS 20, MISSOURI, AND TORONTO, ONTARIO, CANADA

Sales Offices: ALEXANDRIA, VA., • 401 Davidson Bldg. • ALLENTOWN, PA., 821 Linden St. • AMARILLO, TEX., P. O. Box 390 • ANDERSON, S. C. • ATLANTA, GA., 217 Whitehall St., S. W. • BIRMINGHAM, ALA., 1914 First Ave. North • BLUEFIELD, W. VA., P. O. Box 33 • BOSTON 16, MASS., Statler Office Bldg. • BUFFALO 3, N. Y., 564 Ellicott Square Bldg. • BUTTE, MONT., 604 Utah Ave. • CHARLESTON, S. C., 336 East Bay St. • CHARLOTTE, N. C., 124 Brevard Court • CHICAGO 3, ILL., 100 West Monroe St. • CLEVELAND 15, OHIO, Room 607 Hanna Bldg. • CORPUS CHRISTI, TEX., 1329 Staples St. • DALLAS 1, TEX., 512 Thomas Bldg. • DENVER 2, COLO., 612 Insurance Bldg. • DETROIT 2, MICH., 744 New Center Bldg. • DETROIT 2, MICH., 6-253 General Motors Bldg. • GRAND RAPIDS 2, MICH., 412 Hanselman Bldg. • HOUSTON 1, TEX., 4411 Navigation Blvd. • INDIANAPOLIS 4, IND., 907 Roosevelt Bldg. • JACKSONVILLE, FLA., 3323 Thesquena St. • KANSAS CITY 6, MO., 522 Dwight Bldg. • KNOXVILLE 17, TENN., 1243 N. Broadway • LOS ANGELES 15, CALIF., Subway Terminal Bldg. • MEMPHIS, TENN., 1352 Madison Ave. • MINNEAPOLIS 1, MINN., 254 Midland Bank Bldg. NEW ORLEANS 12, LA., 407-408 Industries Bldg. • NEW YORK 6, N. Y., 55 Liberty St. • OMAHA 2, NEBR., 1104-5 WOW Bldg. • PITTSBURGH 22, PA., 1337 Oliver Bldg. PHOENIX, ARIZ., 140 So. Central Ave. • PORTLAND, ORE., 1233 N. W. Twelfth Ave. • PRINCETON, IND., P. O. Box 207 • ST. PETERSBURG 6, FLA., 14212 Palm St., Madeira Beach • SALT LAKE CITY, UTAH, 314 Keenes Bldg. • SAN FRANCISCO 4, CALIF., 407 Hallstreet Bldg. • SAN MARCOS, TEX. • SEATTLE 4, WASH., 332 First Ave., South SHREVEPORT, LA., 630 Spring Ave. • SILVER SPRINGS, MD., 9415 Wise Ave. • SYRACUSE, N. Y., Room 317, State Tower Bldg. • WHEELING, W. VA., 22nd & Market Sts.

job on an alternate bid based on fabricating standards locally of conduit within 30 days.

Three sizes of conduit were welded together as shown to make a stepped pole 26½ ft long. Joints were made by inserting the smaller conduit about one foot inside the larger. A bead was welded around the top of the joint. Then three holes were drilled through the outer wall, plug welded, and ground off smooth. The pole was topped by a standard conduit cap.

A bracket for the luminaire was made of 1¼-in. conduit welded into a hole six inches down from the top of the pole. A ¼ x 1-in. brace was then welded to the bracket and the pole. On the opposite side of the pole a hook was welded to support the lighting transformer. Leads from the transformer enter the pole through a 1¼-in. nipple and are carried inside the bracket to the standard GE mercury luminaire. Insulators to carry overhead circuits are mounted on the pole by through-bolts. Underground circuits are brought up inside the standard to transformers in the base.

Standard May Be Lifted Out

Supporting base for the standard was designed to permit easy removal in case of damage. A 2x2x2-ft hole filled with reinforced concrete serves as the anchor. Before pouring concrete in the hole, a sheet metal sleeve was placed on a cement block and four 16-in. J-bolts placed as shown. The standard slips into the 18-in. sleeve and is welded to a 12x12x½-in. boiler plate anchored by the bolts.

Although delivery was the deciding factor in selecting the standards, a substantial saving in total cost was also very important. Total cost of the standards was 20 to 25% less than for comparable standard units. This meant the difference between a total figure which was within the amount available, and one which would have been turned down, requiring a long delay in revising the desired layout to come within the original estimate.

ELECTRICAL WORLD'S
75th Anniversary Edition
will examine the evolution of
23 separate fields
of engineering activity
COMING MAY 21

KLEIN

"Pole Master"

CLIMBERS*

Gaff is in line with the leg bone.

1945 POLEMASTER CLIMBERS Riveted Top Wrought Loop, Triangular Ring at Ankle (average weight) 2⅞ lbs. per pair. (With this Climber, use Ankle Strap No. 5301-16 or No. 5301-26).

"solid comfort" for linemen

■ There's greater comfort for the lineman in the *new* Klein "Pole Master" Climbers. Designed as a real working pair . . . with one climber especially for the right and the other for the left . . . they have an extra wide stirrup for greater arch support.

Leg irons are tough and dependable, yet flexible and tapered in width and thickness. Ankles and calves get better support . . . chafing is practically eliminated. And the scientifically offset shank brings gaff in proper line with leg bone, providing real security . . . solid comfort.

"Pole Master" Climbers are forged from high quality, special alloy steel. A wrought, triangular-shaped ring at ankle assures proper set of ankle strap and provides additional comfort . . . safer, longer strap life. "Pole Masters" . . . like all Klein climbers . . . are individually tested and suitable for linemen of any weight.

*Matched Right and Left Climbers

ASK YOUR SUPPLIER

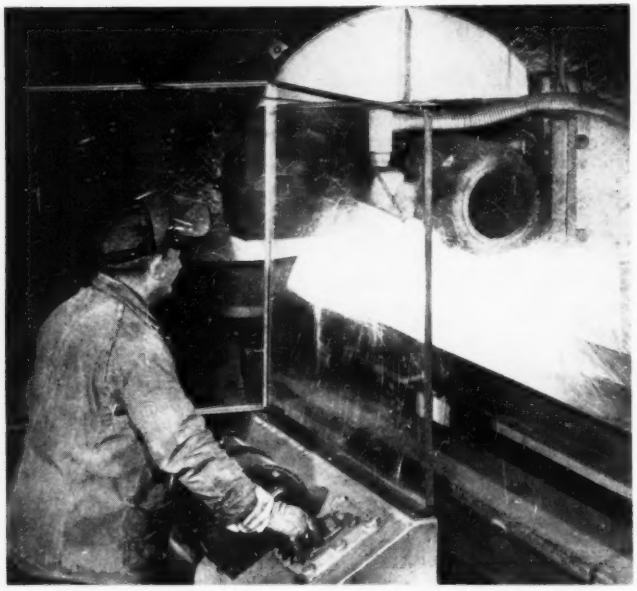
Foreign Distributor: International Standard Electric Corp., New York Since 1857

KLEIN TOOLS EST. 1857 TRADE MARK REG.

Mathias KLEIN & Sons
Established 1857 Chicago, Ill., U.S.A.
3200 BELMONT AVE. CHICAGO 18, ILL.

LOAD BUILDING

Electrified Saw Cuts Steel by "Melting"



REMOTELY CONTROLLED, this high-speed friction saw driven by 150-hp motor makes burrless cuts across heavy steel sections. The saw blade is cooled by water at 240 psi

BIG ELECTRICAL high-speed friction saws that cut steel by melting it now are being used by United States Steel Supply Co for faster and better cutting of heavy steel sections. The 5-ft diam saw makes a clean square cut without excessive burring, which previously required additional time and labor to remove

Electro-Hydraulic System

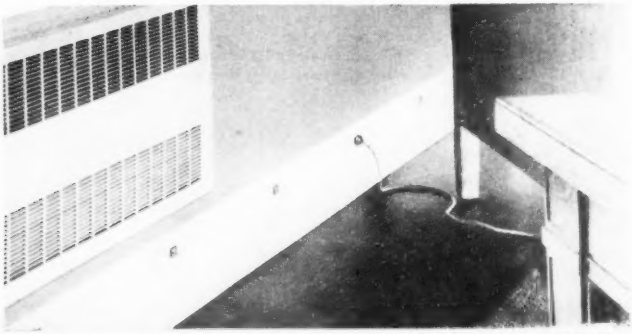
The saw is driven by a direct-connected, 3-phase, 440-v, 150-hp motor and is remotely controlled. Electrically operated feed and take-off rolls, each driven by 15-hp motor, facilitate the handling of the material to be cut. An electro-hydraulic system provides a maximum forward cutting speed of 13 fpm. After the cut, the saw retracts at 51 fpm.

The saw blade is a 60-in. diam steel disk, $\frac{7}{16}$-in. thick, with a serrated edge. At 1,750 rpm the peripheral speed of the saw is about 320 mph. When the rotating blade contacts the material to be cut, friction generates heat faster than the material being cut can absorb it. The intense heat melts the surface of the material, which is carried away by the teeth of the blade. The blade is cooled by air and water. A 30-hp motor drives a centrifugal water pump that supplies 75 gpm at 240 psi. The high pressure is necessary to penetrate the dense air film created by the whirling blade rim.

Protection for Motor

A 600-amp, 575-v, 3-pole, fusible safety switch serves as a main switch for the entire saw installation. For motor protection and starting: The hydraulic system uses a magnetic starting switch; the coolant system uses a starting switch; and the saw motor uses an automatic compensator. The in-feed and take-off roll tables use reversing plugging magnetic controllers. The overload relay for the saw motor is located in the saw control cabinet, with manual reset.

Plug in Anywhere



National Electric Products Corp Photo

ADEQUATE WIRING means plenty of outlets. Preaching that gospel, Pacific Gas & Electric Co followed it in the new 12-story annex to the home office building in San Francisco. Nearly 2 miles of plug-in strip with outlets every 18 in. are installed on the walls and partitions

Hotpoint's Ahead

WITH THE Greatest Dishwasher Ever!

Sensational 1949 Model Wins Enthusiastic Dealer-Consumer Acceptance For Industry's Leader!

AGAIN Hotpoint heads the field—this time with the amazing 1949 Hotpoint Automatic Electric Dishwasher which offers almost unlimited sales opportunities for dealers everywhere!

For here's the appliance women everywhere want—the greatest time- and work-saver ever invented for their kitchens! It double washes, double rinses and dries dishes hygienically clean . . . and it does the entire job automatically.

•

You Get Hotpoint's Famous Selling Features:

TABLE TOP ELECTRIC DRYING

Plus exclusive Impeller Screen, Front Opening, Top-Spray Action and 12 great 1949 advancements.

New '49 sales clinchers include gasketless door that closes like an oven door, simplified drain system, steam baffle and many more. With achievements like these, is it any wonder dealers call Hotpoint "the franchise with a future!"

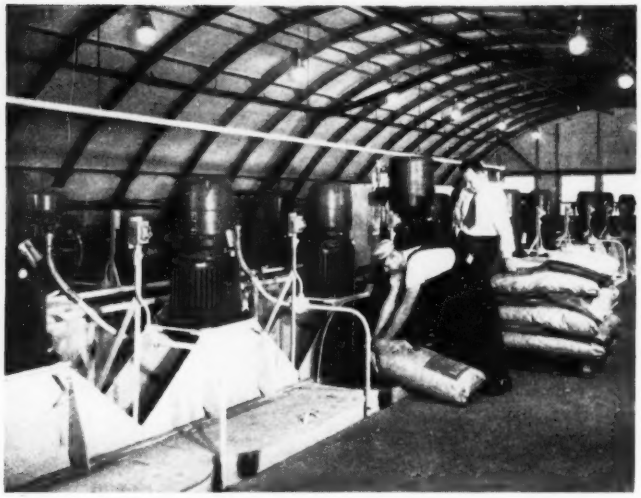
Hotpoint Inc. (A General Electric Affiliate) 5600 W. Taylor St., Chicago 44, Ill.

Everybody's Pointing To

Hotpoint

Ranges • Refrigerators • Water Heaters • Freezers • Dishwashers
Disposalls® • Clothes Washers • Dryers • Ironers • Cabinets & Sinks

Individual Gearmotors Drive Laquer Mixers



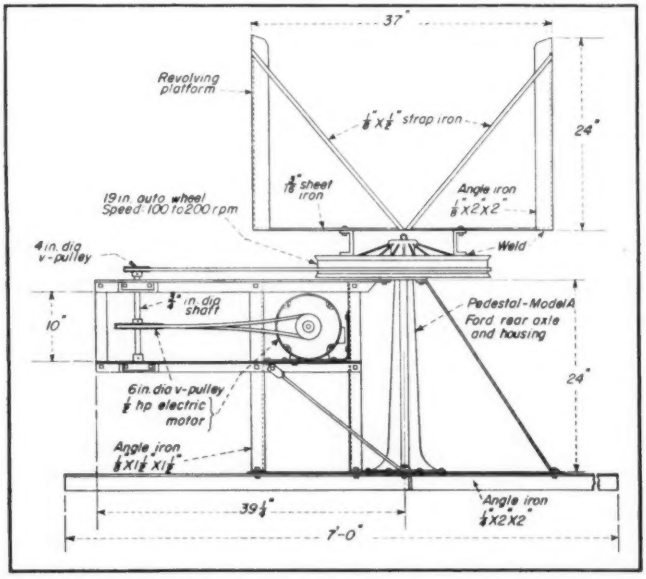
TWENTY-TWO explosion-proof vertical gear motors drive turbine-type agitators

VERTICAL EXPLOSION-PROOF gear motors are used for the 22 mixing and dispersion tanks at Arco Co's new lacquer plant in Cleveland, Ohio.

The motors meet Class I-D requirements and are 220 v, three phase, 60 cycle. Seven motors are 5 hp; twelve are 7½ hp; and three used for handling material of heavier viscosities are 25 hp. Each motor is controlled individually by a locking type push button station.

The new plant, which can process 22,000 gal of lacquer simultaneously, has many special safety features. All fixtures are explosion-proof. The main building uses floor-level ventilation, self-closing covers on mixing tank, and 8-in. water lines for supplying the sprinkler system. The Quonset-type buildings are spray-coated with fire-resistant insulation. Motors are mounted on sparkproof concrete mezzanine.

Centrifuge Dries Dipped Holly



HOLLY in wire baskets is dipped into a solution of preservative (fruitone). After draining for a few minutes, a basket is placed on the revolving platform and spun to remove excess liquid. For 100 lb of dipped holly about one gal of liquid will be removed. From the centrifuge the holly is brought indoors for packaging. This solution to the problem of drying holly was worked out by the agricultural experimental laboratory of the Puget Sound Power and Light Co

Electric Furnace Makes Steel Die Casting Practical

ROBERT B. STANTON
Alhambra, California

STEEL PRODUCTS in weights from a few ounces to about 15 lb are now being die cast, at an estimated production cost 50% less than for ordinary molding processes. The injection press used was developed by the Hisgen Machine Tool Works, Los Angeles, and is an example of the solution of a difficult problem by the use of modern materials. All parts of the injection mechanism are lined with tungsten carbide or high chrome steel for maximum temperature resistance. Silicone lubricants are used in machining the dies from drop-forged steel.

Contributing importantly to success of the operation is an Ajax-Northrup induction melting furnace which has a capacity of about 500 lb per hr, and supplies the molding metal at a temperature held between the necessary minimum limits.

Energy for the furnace comes from a 175-kw motor-generator. The furnace has been designed to tilt and pour directly into the loading hopper of the press.

800 ohms/cmf

Temp. Coeff. of Resistance:
± 0.00002 max. from −50°c to +100°c

karma

the improved electrical resistance alloy!

Higher Ohmage makes possible Smaller Resistors—Increased Savings

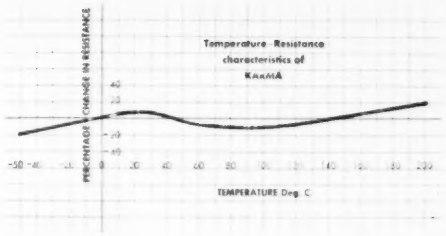
Compared with Manganin and Constantan (Advance*), the copper-base alloys widely used for high accuracy wire-wound resistors, the electrical resistivity of Karma* is exceptional — 800 ohms per circular mil foot, at 20°C, it is more than 2.7 times greater. Now you can wind even smaller precision resistors at still lower cost per ohm.

More Stable Resistance permits Wider Applications—at Wider Temperature Ranges

The comparably Low Temperature Coefficient of Resistance of Karma remains constant over a very much wider temperature range than that of Manganin or Constantan (Advance*). The "useful range" of Karma is more than 8 times that of Manganin and 4 times that of Constantan (Advance*). Karma, therefore, is especially adapted for service in precision resistors that are subjected to severe changes in temperature.

Low Thermal EMF Value against Copper assures Extreme Accuracy

In cases where error due to voltage generated by thermal EMF against copper must be confined to negligible proportions, Manganin has long been accepted as ideal for resistor windings. The thermal EMF value for Karma against copper is equal to that of Manganin itself!



High Resistance to Oxidation prolongs Electrical Properties

The superior surface oxidation resistance of Karma, essentially a nickel chromium alloy, enables it to retain its fine electrical properties longer than the copper-base alloys Manganin and Constantan (Advance*).

Higher Tensile Strength permits Faster Winding Speeds — saves Production Time

In addition to its outstanding electrical qualities, Karma affords physical advantages over the commonly accepted alloys. Its higher tensile strength permits faster winding speeds; its lower thermal expansion minimizes distortion and movement in windings.

In a word, this urgently needed Driver-Harris alloy offers *plus values all along the line*. Ask us about it. We shall be glad to supply you with complete data.

50TH YEAR 1899 - 1949 SPECIAL PURPOSE ALLOYS SINCE 1899 TRADE MARK REG. U.S. PAT. OFF.

KARMA is manufactured only by

Driver-Harris Company

HARRISON, NEW JERSEY

BRANCHES: Chicago, Detroit, Cleveland, Los Angeles, San Francisco, Seattle

Manufactured and sold in Canada by
The B. GREENING WIRE COMPANY, LTD., Hamilton, Ontario, Canada

*T.M. Reg.U.S.Pat.Off. *Formerly D-H experimental alloy #331

NEW EQUIPMENT

Radio Noise Detector

DESIGNED to locate radio noise sources on all types of electrical power circuits, a radio noise detector having only one operating control has been announced by Eltron, Inc. Jackson, Mich. The manufacturer reports that the device gives reliable information as to amount and location of noise.

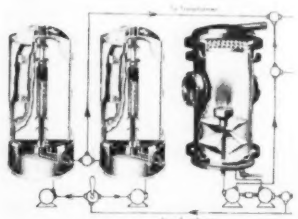
The complete set includes a 4½ x 7 x 10½-in. radio detector with an illuminated output indicating meter; weighs 11 lb; and is tuned to a frequency free from broadcast or code interference. For checking overhead distribution lines, the loop antenna may be mounted on a vehicle; readings may be taken while the vehicle is in motion.

•

Oil Purifier

A COMPLETE system for purifying, dehydrating and dega-ifying insulating oil, either in the field or at a central station location, is manufactured by Homan-Crane Corp. 731 Wabash Ave. Lebanon, Ind. Known as the Houdaille Purivac unit, the system is designed for two stage operation—purification and dehydration.

It consists of dual Cranite purifiers,



pumps and motors, a vacuum dehydration and degasification unit with high and low pressure pumps, central operation panel board for all controls, interconnecting piping, valves and accessories. All equipment is mounted and conveniently arranged on a floor truck or skid for portable use.

The advantage of two separate cycles is said to lie in increased flexibility, the use of a smaller dehydration unit and longer nozzle life, as only purified and filtered oil goes to dehydration unit. Purifiers may be operated either singly or in parallel; thus, adequate flow may be obtained to assure a minimum conditioning time. The system also permits counter-flow operation.

•

Small-Diameter Motor

DESIGNED to drive hermetically-sealed refrigeration compressors, a small-diameter motor has been announced by

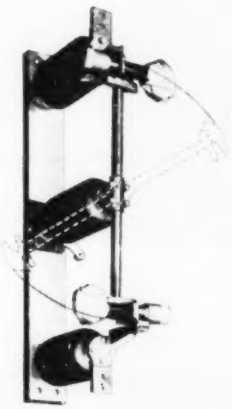
General Electric's Fractional Horsepower Motor Divisions.

With a diameter of 4.790-4.792 in., it is available in ratings up to ⅛ hp, 1725 rpm, 115 v, 60 cycles. The motor can be furnished with a rotor having a counterbored quill or with punchings made to fit directly over the shaft.

•

Interrupter Switch

ADDED to the Alduti interrupter switch line is a new development in higher voltage ratings, 24-kv and 34.5-kv, announced by S & C Electric Co. 4435 Ravenswood Ave. Chicago, Ill. Currents of 600 amp have been inter-



rupted. Reported installation advantages are: Closer than standard phase spacings, simplification of structure, installation indoors and in a metal enclosure, and installation outdoors without metal enclosures. In a group the units are operated by an indirect, manually controlled mechanism.

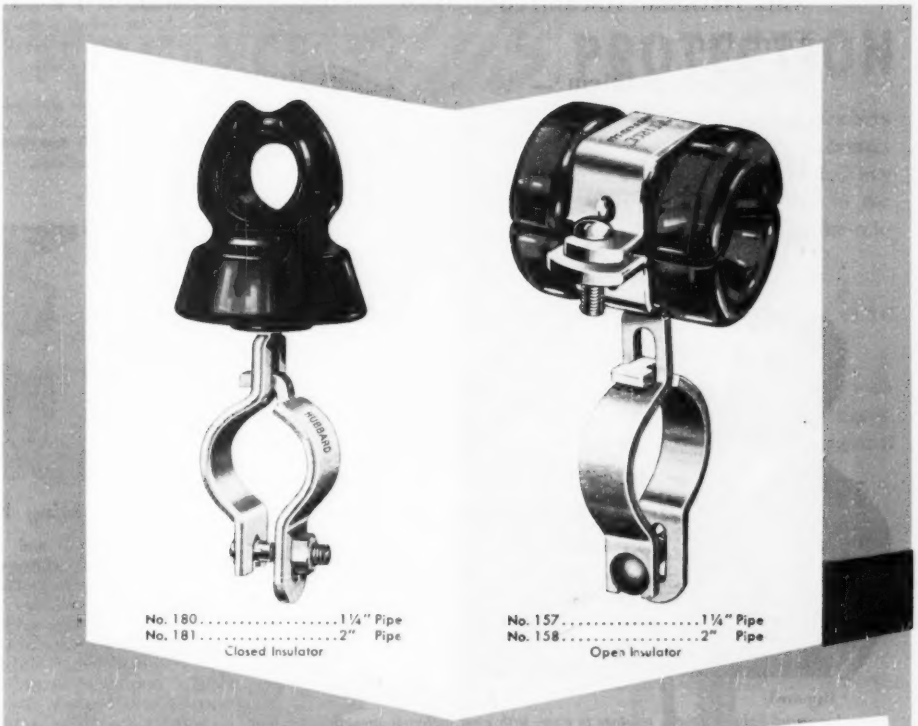
In opening the switch, the operating mechanism causes the individual switch blade to open by a sidewise swing of 90 deg. The blade shunts the current through interrupter units, thereby permitting the main contacts to open without arcing. The interrupter units have contacts within an interior structure that is designed to provide conditions favorable to arc extinction. The internal contacts are operated by levers actuated by the blade movement.

•

Battery Chargers

FOR CHARGING 15-18 cells of lead battery, or 20-24 cells of Edison battery, of the electric truck type, a line of selenium rectifiers has been designed by Fansteel Metallurgical Corp, North Chicago, Ill.

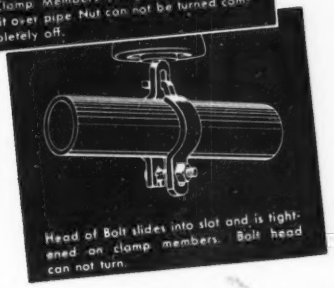
Operation is said to be automatic in that the operator merely connects the battery to the charger and sets the electric time switch. Lead batteries can be charged by the two rate or modified constant potential system. Edison batteries can be energized at an almost



No. 180.....1¼" Pipe
No. 181.....2" Pipe
Closed Insulator

No. 157.....1¼" Pipe
No. 158.....2" Pipe
Open Insulator

Clamp Members swing apart freely to fit over pipe. Nut can not be turned completely off.



Head of Bolt slides into slot and is tightened on clamp members. Bolt head can not turn.

Labor Saving—

HUBBARD ONE BOLT TYPE LAMP LEAD BRACKETS

Hubbard Research and Development Engineers have, by their own volition, established a sort of "Sword of Damocles," which they like to imagine is hanging over their heads, and which bears the related admonitions—"Greater Efficiency!"—"Fewer Parts!"

Consequently, they strive to follow these directions in every new design which they conceive, and are constantly reviewing old products to improve, if possible, their original thinking. The Lamp Lead Brackets illustrated above are but one of many items which have kept the sword from dropping. "Greater Efficiency" and "Fewer Parts"—Both characteristics have been built into Numbers 180, 181, 157 and 158.

HUBBARD AND COMPANY

PITTSBURGH
CHICAGO

OAKLAND,
CALIF.

"This National Vulcanized Fibre Part solved our problem*— assured us a product which performed perfectly."

*Required:
A material light in weight, resistant to wear, with good dielectric strength, ready machinability. National Vulcanized Fibre with all these qualities, plus— was the perfect answer.

In your development of efficient, economical products, it pays to investigate

NATIONAL VULCANIZED FIBRE

A tough, horn-like material with high dielectric and mechanical strength. Excellent machinability and forming qualities, great resistance to wear and abrasion, long life, light weight. Sheets, Rods, Tubes, Special Shapes.

PHENOLITE Laminated PLASTIC

About one-half the weight of aluminum, possesses an unusual combination of properties—a good electrical insulator, great mechanical strength, high resistance to moisture; ready machinability. Sheets, Rods, Tubes, Special Shapes.

PEERLESS INSULATION

The *first* fish paper developed for electrical insulation. Strong, smooth, flexible, with excellent forming qualities. High dielectric strength. Sheets, Rolls, Coils.

To help you solve your specific development problem—National Research and Engineering Service available without obligation.

NATIONAL VULCANIZED FIBRE CO.
WILMINGTON DELAWARE
Offices in Principal Cities
Since 1873

constant rate for a desired length of time. At the end of a charging cycle, the battery is disconnected from the rectifier and the a-c supply is disconnected automatically.

Necessary controls and indicating instruments are mounted on outside panels. Bulletin 6.500 describes the four standard models available.

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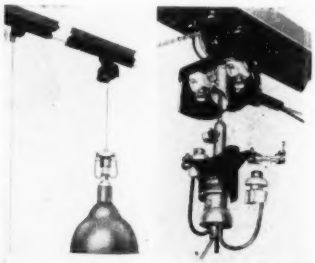


Overhead Lighting Hanger

A DISCONNECTING and lowering hanger, for use with all types of high-level lighting fixtures located 16 or more feet above floor level, has been announced by the Thompson Electric Co, 1101-14 Power Ave, Cleveland 14, Ohio.

This installation, Model L-141 Hanger, consists of upper and lower assembly units, length of chain or cable for lowering and raising lighting fixture, positive locking device and a pulley. Fixed upper assembly unit carries a pair of cup type contacts to which power feed lines are attached. Lower assembly unit is fitted with two engaging contacts which complete the circuit when assembly is in raised position.

Hangers are available for indoor or outdoor installations using incandescent, fluorescent or mercury-vapor lighting and will support fixtures weighing up to 200 lb. They are UL rated for 15-amp, 600-v or 30-amp, 250-v a-c operation and 20-amp, 250-v d-c operation.

•

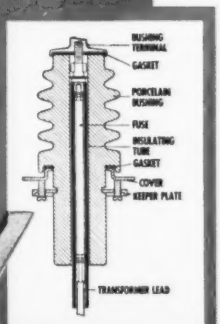
Enclosed Starter

DEVELOPED for Class I, Group D hazardous locations, a combination starter for squirrel-cage, synchronous and wound-rotor motors up to 600 hp at 2,300 and 4,600 v, 60 cycles, or up to 300 hp at 2,300 v and 250 hp at 4,600 v, 25 cycles is announced by The Electric Controller & Mfg Co, Cleveland 4, Ohio.

Known as the Valimitor starter, this unit is said to provide unlimited short circuit protection by limiting a fault current in the motor circuit to 25,000 kva (steady state current), regardless of the available kva of the system. The Type ZHS magnetic contactor, 50,000-kva interrupting capacity, is more than

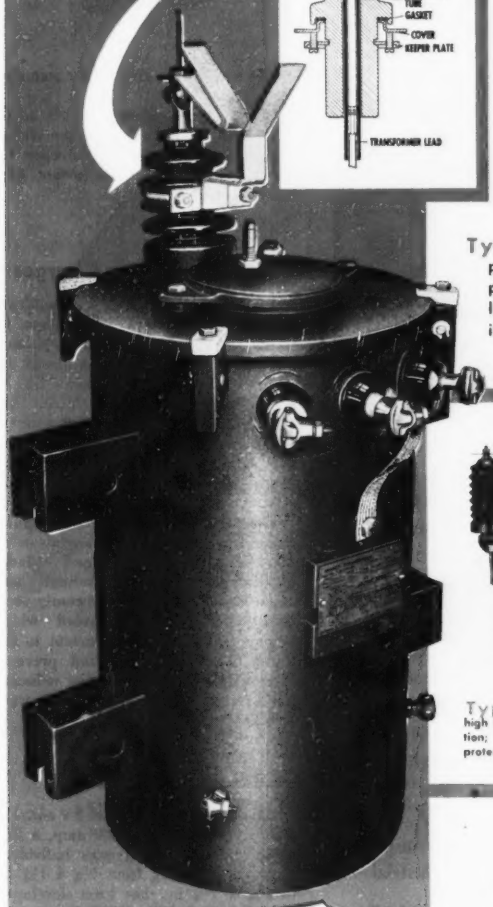
PERFORMANCE *PLUS* PROTECTION

When you install pole-type transformers on your rural line, choose Wagner Transformers and be sure of dependable, efficient service. They have established enviable service records in the field, and uphold the Wagner reputation for reliable transformer performance.

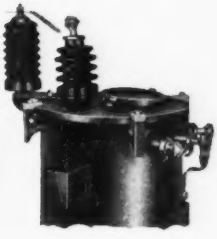


Wagner makes a complete line of Rural Transformers

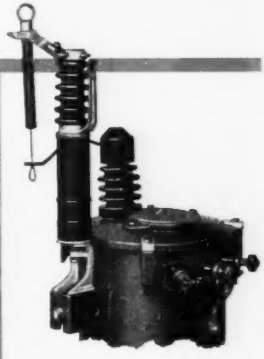
The Wagner line offers a selection of types with protective features to meet your specific needs. In addition to the types shown, a conventional type HEF is also available.



Type HEF-5: Double "bird-proof" gap provides surge protection; internal fuse, shown in diagram above, forms a protective link between the transformer and the high voltage line to prevent "line lockout" if the transformer is damaged in operation.



Type HEF-3: De-ion Gap on high voltage side provides surge protection; secondary circuit-breaker provides protection against overloads.

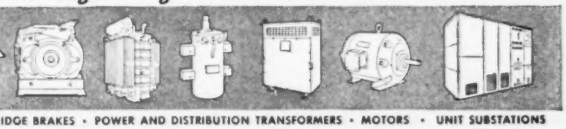


Type HEF-7: Expulsion-type lightning arrester provides surge protection; primary overload limiter link protects against overloads.

For further information on Wagner Rural-Line Transformers, write for Bulletin TU-1C.

Wagner Electric Corporation
6456 PLYMOUTH AVE., ST. LOUIS 14, MO.

Consult Wagner Engineers on All Transformer Problems



BRIDGE BRAKES • POWER AND DISTRIBUTION TRANSFORMERS • MOTORS • UNIT SUBSTATIONS

T49-5

ELECTRICAL EQUIPMENT AND AUTOMOTIVE BRAKE PRODUCTS

CHAMPION LAMPS

FOR QUALITY:

Guaranteed to equal or exceed Federal Specifications. Produced, inspected and tested by one of the largest and best-equipped manufacturers in the business—makers of dependable lamps for industrial service for fifty years.

FOR ECONOMY:

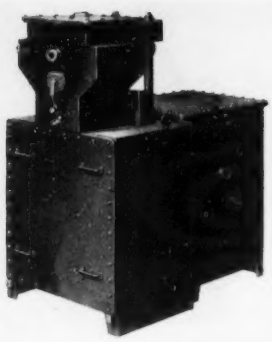
Minimum lamp and lighting cost is assured when you buy CHAMPIONS, as a result of low overhead and direct sale through qualified electrical and industrial distributors.

BOOTH NO. 136

CHAMPION LAMP WORKS

Lynn, Massachusetts

A DIVISION OF CONSOLIDATED ELECTRIC LAMP CO.



ample to clear the circuit, the manufacturer states.

Features of the starter include an oil disconnect switch to isolate the starter and inverse time element protection for prolonged overloads and instant tripping on short circuit.

•

Floating Battery Charger

To be used in applications requiring accurate control of floating voltage, an electronically controlled and regulated floating battery charger has been developed by Power Equipment Co, 55 Antoinette St, Detroit 2, Mich. The standard charger is fully automatic in operation, has constant potential output, and is designed to maintain floating charge on the battery group to within plus or minus 1%.

The manufacturer advises that regulation is accurate over a relatively wide range of output voltages and is independent of a-c line voltage and frequency fluctuations. Electronic overload protection is provided which automatically limits the current to the preset maximum value and prevents overloading of the charger by reducing the terminal voltage below the battery voltage.

•

Selenium Rectifiers

Covering the range from 2 v and 150 ma to 5,000 v and 10,000 amp, a line of selenium rectifiers, with individual plate sizes ranging from $1\frac{1}{4}$ x $1\frac{1}{4}$ in. to $6\frac{1}{4}$ x $7\frac{1}{4}$ in., has been developed by International Rectifier Corp, 6809 S. Victoria Ave, Los Angeles 43, Cal. According to the manufacturer, the plates are assembled in a unique interlocking arrangement between the plate and insulating sleeving so as to prevent possible plate rotation or lug misalignment.

Characteristics of the rectifiers include: Individual plates capable of withstanding 24 v rms maximum in the

In Plastics

IT TAKES TIME TO TELL THE DIFFERENCE

Two plastic wires may look as alike as two peas in a pod—but that doesn't mean they will act alike—through the years.

The compounding of plastics is most essential—just as in the case of rubber insulated wire.

That's why it pays to buy a make of plastic wire you can depend upon.

You can't go wrong by specifying Densheath*. This plastic insulation was pioneered by Anaconda *13 years ago*. This remarkable insulation is long-aging . . . won't burn . . . is impervious to acids, oils and alkalies. For quick, trouble-free installation, Densheath offers great resistance to abrasion . . . smooth, slick finish with no braid . . . easy fishing and clean stripping.

The Anaconda Plastic Laboratory is constantly at work to better existing insulations. It is there for *you* to use, too. And an entire Anaconda plant with the latest in equipment is ready to give you the best in service as well as product.

*Reg. U. S. Pat. Off.

FOR PLASTIC INSULATION, MAKE ANACONDA HEADQUARTERS

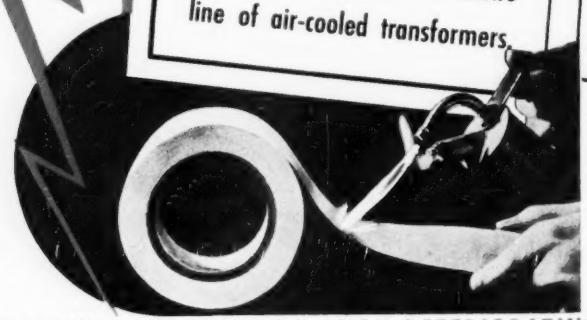
ANACONDA

Anaconda **Densheath** *Thermoplastic* INSULATED WIRE AND CABLE

Anaconda Wire & Cable Company, 25 Broadway, New York 4, N. Y.

NEW! A Good Transformer MADE BETTER!

MTC uses the new JOHNS-MANVILLE *Quinterra* insulation throughout its entire line of air-cooled transformers.



INORGANIC • HEAT-PROOF • NON-DETERIORATING ELECTRICAL INSULATION

AIR-COOLED TRANSFORMERS
1 to 1,000 KVA up to 15,000 Volts to meet Individual Requirements

- DISTRIBUTION
- GENERAL PURPOSE
- PHASE CHANGING
- ELECTRIC FURNACE
- RECTIFIER
- WELDING
- MOTOR STARTING

Insulation determines the working life of an air-cooled transformer. Marcus Transformers have always been known for their use of superior Class B and C heat-proof insulation. In this phase of construction, MTC has pioneered many noteworthy firsts. AGAIN, MTC is pioneering in the use of *quinterra* throughout its entire line of air-cooled transformers. That's why when air-cooled transformers are specified or needed, the reputation of Marcus stands pre-eminent in its field. That's why we invite your inquiry with confidence, knowing that once you have utilized a Marcus air-cooled Transformer, you will specify no other.

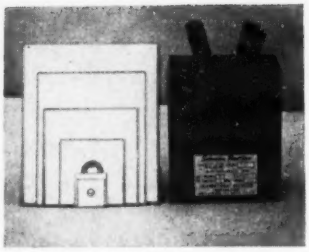
GOOD DELIVERIES • FIRM PRICES
NO ESCALATOR CLAUSES

MTC

MARCUS TRANSFORMERS CONFORM TO THE STANDARDS OF N.E.M.A. AND A.I.E.E.

MARCUS TRANSFORMER CO. INC.
30 MONTGOMERY STREET
HILLSIDE 5, NEW JERSEY

PIONEERS IN THE FIELD OF AIR-COOLED TRANSFORMERS



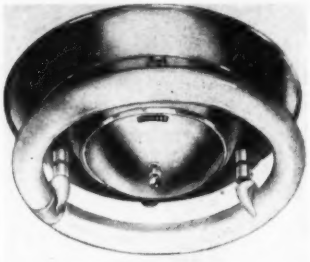
reverse direction and overload up to 10 times rated load for periods of 7 sec or less; leakage of less than 1 ma/cm² at maximum reverse voltage; efficiency varying from 65 to 85% depending upon the circuit employed; and a change in voltage less than 5% after the first 10,000 hr of use.

Illustrated are individual plates (left) and a complete assembly (right).

•

Fluorescent Fixture

DESIGNED as a plug-in unit for kitchen, living room or hallway fixtures, this 32-w circular bulb produces light equivalent to a 100-w lamp, according to the manufacturer, Prevore Electric Mfg Corp, Brooklyn 16, N. Y. It is also



available for flush mounting and has UL listing.

A variety of finishes include aluminum and chromium on steel, in colors of green, blue, rose, gold, red or bronze.

•

Recording Instrument

A CURVE of the number of operations against time can be plotted with this recording instrument announced by The Bristol Co, Box 1790, Waterbury 91, Conn. Known as the Running-Count Recorder, it records the total count of intermittent operations and the time at which each one occurs, and can be used on production machinery to record work-producing operations or number of pieces produced.

The total number of operations or pieces produced can be easily found

Snap-on Bench Grinders

with the famous Blue-Point Trade Mark

. . . have the construction features for smooth, powerful operation . . .

COMPLETELY ENCLOSED MOTOR: Super-powered, precision-balanced motors enclosed to prevent dirt, grit, etc. from entering.

BALL BEARING CONSTRUCTION: Oversize, grease sealed ball bearings used throughout, assure smooth motor operation.

LARGE RUGGED BASE: Rubber feet provide solid mounting free from vibration. Recessed bolt openings for permanent mounting.

INDUCTION RUN MOTOR: Develops less heat in the windings — more desirable for continuous operation.

STURDY TOOL RESTS: Adjustable for any type of work with ample take-up for wheel wear.

LARGE WHEEL GUARDS: Allow use of special shape grinding wheels or wire brushes. Guards fitted with chip breakers.

BELL TYPE CONSTRUCTION: Provides full clearance so that long straight pieces may be ground across the face of the machine.

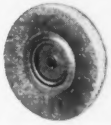
CAPACITOR START MOTOR: Uses low starting current . . . actually less than 15 amps. are consumed.

VOLTAGE: Standard models of the ⅓ H.P. and ½ H.P. grinder require 110 Volts, 50/60 cycle AC current. Standard 1 H.P. grinder takes 220 Volts, 50/60 cycle AC current. Special voltage models available.

GRINDING WHEELS

of natural aluminous oxide abrasive . . . fully vitrified. From 60 grit for fine grinding to 24 grit for heavy work.

WIRE WHEEL BRUSHES



High quality wire and metal, bound to prevent chips flying loose. Crimped bristles cannot bend or break.

WHEEL DRESSER

Quickly trues, cleans grinding wheels. Protective hood over cutters. Includes extra set of easily inserted cutter wheels.

STURDY EYE SHIELDS

Thick safety glass for clear vision, protection. Sturdy aluminum frame. Easily attached to grinder.

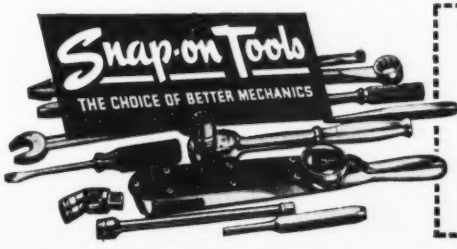
DRILL GRINDING ATTACHMENT

Sharpens any drill from 3/32" to ½" in diameter with both lips ground identical in length, clearance and angle. Micrometer screw controls feed.

SNAP-ON TOOLS CORPORATION

8108-B 28th AVENUE • KENOSHA, WISCONSIN

International Division: Kenosha, Wis., U. S. A.



SNAP-ON TOOLS CORPORATION
8108-B 28th Ave., Kenosha, Wisconsin

Please send me catalog containing more details about Bench Grinder and accessories.

Name.....

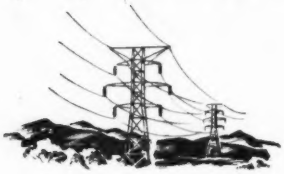
Position.....

Company.....

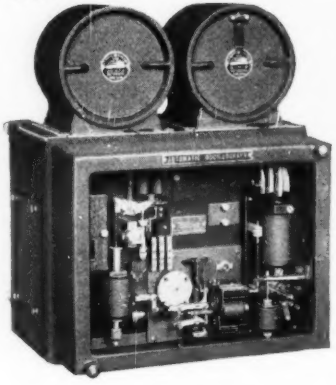
Address.....

City..... (.....) State.....

Lightning-Fast Records..



..with this G-E Automatic Oscillograph type PM-13



In one quarter cycle this automatic instrument goes into action. It provides you with detailed, graphic records of how your power system behaves under all fault conditions. This information can help you

1. Reduce loss of service. Faults are more quickly located for repair
2. Save money on special patrol expense
3. Detect minor faults before they cause major damage
4. Determine causes of system instability
5. Supervise relay and breaker operation.

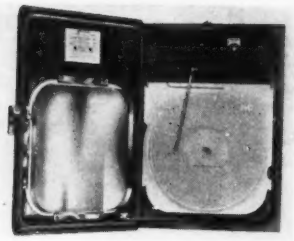
THE PM-13 IS FULLY AUTOMATIC. No operator is needed. It starts (in 1/240 second), records entire disturbance, and stops after fault has been cleared. Operation can be initiated by any device that will break a circuit, so it is suitable for use at an unattended station. It will make 100 oscillograms without attention.

CLEAR, WELL-SPACED RECORD. A special arrangement prevents crowding at the start, and the lamp burns more brightly at that time to assure a clear starting record. The trace paper is 4¼ inches wide. This permits ample separation of traces yet avoids the high cost of wider paper.

DEPENDABLE OPERATION. This oscillograph operates from its own power source (automatically kept at full voltage). During the standby period the only part energized is the light source—no moving parts to wear out or require attention. No special skills are required to care for it.

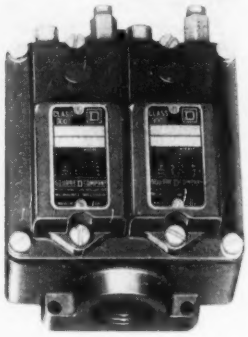
MORE ADVANTAGES—Built-in alarm contacts, adjustable record length (two to twenty feet), and time-stamp identification (date, hour, and minute of record) are just some of the other reasons why you'll appreciate every PM-13 in your system. You can order now from your nearest G-E representative. Or, if you want more information, write for Bulletin GEC-396. *Apparatus Dept., General Electric Company, Schenectady 5, N. Y.*

GENERAL ELECTRIC



by multiplying the number of complete pen transverses across the chart by the count per transverse for which the instrument is calibrated. The hourly rate of production can also be easily read from the chart.

•



Limit Switch

A DUPLEX switching unit that can be used where two limit switches are needed is manufactured by Square D Co, 4041 N. Richards St, Milwaukee 12, Wis. This duplex switch can also be used to replace two separate limit switches on present installations, according to the company.

Both surface mounting (illustrated) and flush mounting types are available in oiltight assemblies. Housed in melamine cases, each switch has a s.p.d.t. snap action mechanism and two circuits —one normally open, the other closed.

Switches may be specified to include either two push rods, two plain roller arms or two one-way rollers; have a-c and d-c rating to 600 v; will operate in temperatures up to 200 F.

•

Metal Parts Analyzer

MODEL C cyclograph operates on the core loss principle and is applicable to the non-destructive checking or sorting of metal parts on the basis of analysis, structure, hardness, case depth, and in

FACTS about

INSULATING OIL MAINTENANCE

for Transformers and Circuit Breakers

This bulletin explains how the Hydro-Volifier—an exclusive Bowser process—restores oil dielectric to 35 k.v. in a single pass.

Write for your copy today. It gives you case histories and a complete description of the process.

Every power transmission engineer should have a copy of this bulletin!

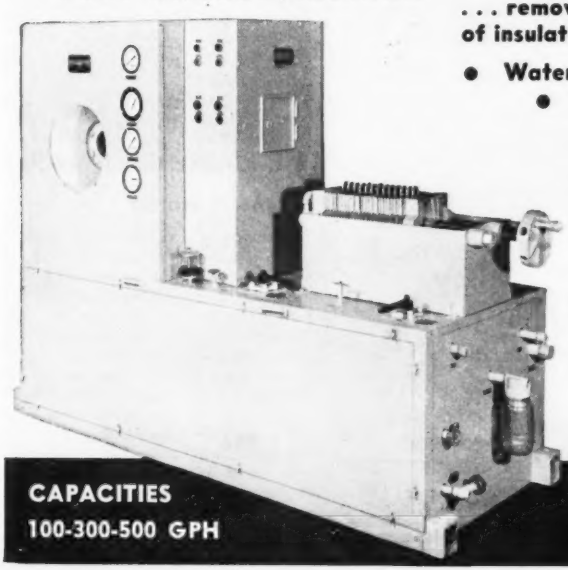
BOWSER, INC.
1384 Creighton Avenue
FORT WAYNE 2, INDIANA

The BOWSER
ESTABLISHED 1885

HYDRO-VOLIFIER

. . . removes all four of the main enemies of insulating oil:

• Water • Air and Gases • Solids • Volatile Corrosive Acids

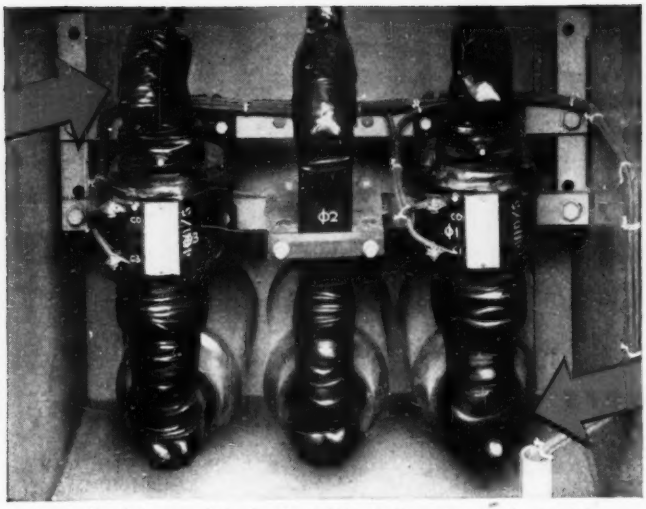


only 2 simple steps

1. **"Atomizing" the oil into minute particles to expose maximum surface area.**
2. **Performing the atomizing operation in a high vacuum to separate the deteriorating elements from the oil and to prevent their re-entry.**

CAPACITIES
100-300-500 GPH

LIQUID CONTROL SPECIALISTS
SINCE 1885



Rear of switchgear cubicle showing 2,300 volt line-connectors insulated in 5,000 volt classification with "Scotch" Electrical Tape No. 22—anticipating a future increase to over 4,000 volts.

Two "Powerhouse" Tapes
For Powerhouse Installations

QUICK FACTS

about "SCOTCH" Electrical Tapes

No. 33 and No. 22

- Tough, impervious plastic backing.
- Stretchy, to conform to odd shapes.
- High Dielectric Strength.
- Thin Caliper (.007"), takes up minimum room in junction boxes, etc.

No. 33—For jobs where extra width is not a factor. Available in standard ¾ inch width.

No. 22—For heavy installations needing maximum coverage. Available in up to 4 inch widths.

"SCOTCH" Electrical Tapes No. 33 and No. 22—Plastic Backed—are tough, stretchy, impervious, and remarkable for *high dielectric strength, with thin caliper*. In a relatively short time they have stepped into the key spot for heavy insulation work on powerhouse equipment.

No. 22 is intended for very heavy installations and maximum coverage on bus bars, etc. No. 33 is used wherever the extra width of No. 22 is not a factor. "SCOTCH" Electrical Tapes with plastic backing are easier to apply than other insulating material, and the completed job is highly efficient, shipshape and mighty good looking.

If you are not familiar with these remarkable new "SCOTCH" Electrical Tapes, a letter to us requesting complete information and samples will have our best attention.

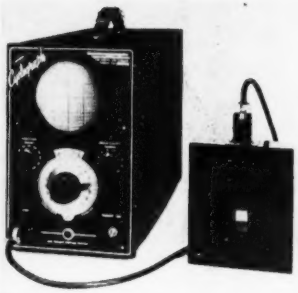
REG. U.S. PAT. OFF.
SCOTCH
BRAND
Electrical Tapes
No. 33 and No. 22

ANOTHER 3M COMPANY PRODUCT

MADE IN U. S. A. BY

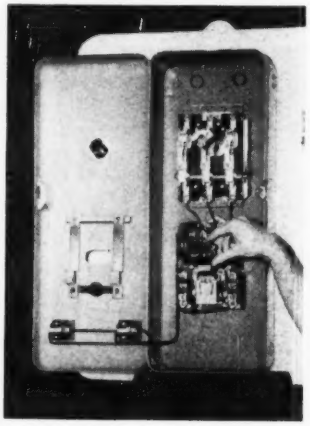
MINNESOTA MINING & MFG. CO. SAINT PAUL 6, MINN.

GENERAL EXPORT: DUREX ABRASIVES CORP., 240 NORTH AVE., NEW ROCHELLE, N. Y.
IN CANADA: CANADIAN DUREX ABRASIVES LTD., BRANTFORD, ONTARIO



some cases, stress concentration. This portable instrument is manufactured by J. W. Dice & Co. 191 River Rd, Grand View-on Hudson, N. Y.

The wide range of test frequencies available in the instrument (2 kc to 200 kc) makes possible a variety of nondestructive analyses. The test coil may be placed up to 12 ft from the instrument. The analyzer weighs 50 lb, operates on 115 v, 40-60 cycles. Power consumption is stated to be 70 w.



Magnetic Starter

DESIGNED to give maximum protection to a-c motors up to 50 hp, 440 v, a magnetic motor starter and magnetic contactor has been placed on the market by The Trumbull Electric Mfg Co, Plainville, Conn. The manufacturer claims the starter will provide longer contact life and more quiet operation.

Features of the starter are reported to be: Bi-metallic relay heaters that will accurately follow the heating curve of the motor, with automatic or manual reset; a plastic-encased coil for protecting windings from moisture, corrosion and abrasion; and a self-lubricating composition impregnated into the plastic to eliminate low voltage chatter.

MORE POWER THROUGH WIRES BY U. S. RUBBER

SMALLER DIAMETER CONTROL CABLES INSULATED WITH Laytex*

NO OTHER CONTROL CABLE HAS Laytex INSULATION

Great news for the power industry! U. S. Rubber Control Cables present unique advantages—thanks to Laytex (90% pure rubber) insulation.

First, Laytex insulation means fully insulated conductors of smaller diameter resulting in smaller diameter cables—this permits *more cables in a given space.* By U. S. Rubber's dip process, the conductors are perfectly centered in the insulation, eliminating any chance of thin spots.

Next, Laytex provides a more efficient and trustworthy insulation, unexcelled in electrical qualities. Dielectric and tensile strengths are extremely high.

Laytex also has very low water absorption, and high aging and moisture-resistant properties.

The vast network of Control Cables is of tremendous importance in any power system. You can't afford not to use the best. Name your operating conditions—you'll find that no cable does a better job than "U. S."—because *no other cable has Laytex insulation.*

Send today for a sample plus booklet containing more details about this new wire. Write Wire and Cable Department, United States Rubber Company, 1230 Avenue of the Americas, New York 20, N. Y.

*Reg. U. S. Pat. Off.

SMALLER DIAMETER MEANS MORE CABLES IN A GIVEN SPACE
U. S. Control Cable (7 conductor) insulated with Laytex
Ordinary 7-conductor Control Cable
U.S.
U.S.RUBBER
SERVING THROUGH SCIENCE

For High Serviceability

and Low Replacement Costs-specify

KOPPERS Long-Life Poles

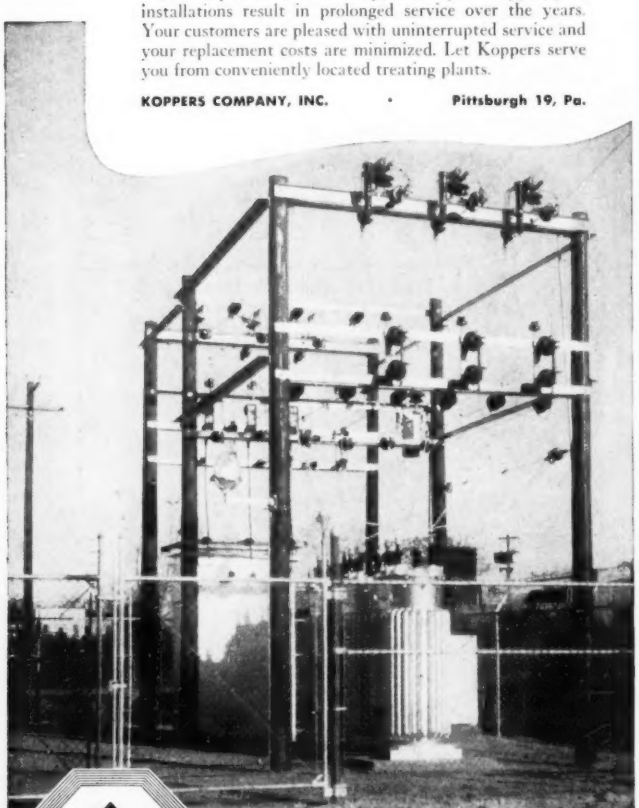
WITH maintenance and construction costs rising, engineers, purchasing agents, and management are all seeking the best possible value from money to be invested in poles.

Koppers Full-Length Pressure-Creosoted Poles offer proved performance. They have an average life span of *more than 30 years.*

Dependability is assured by experienced men of Koppers who pride themselves in turning out poles that will stand the test of time.

Proved performance and dependability of Koppers pole installations result in prolonged service over the years. Your customers are pleased with uninterrupted service and your replacement costs are minimized. Let Koppers serve you from conveniently located treating plants.

KOPPERS COMPANY, INC. • **Pittsburgh 19, Pa.**



KOPPERS **PRESSURE-CREOSOTED WOOD**

MORE NEW PRODUCTS
about which you should know

Milwaukee Electric Tool Corp, Milwaukee, Wis., has available a pistol-grip type "Hole-Shooter" **electric drill,** driven by a universal 115-v motor, in three drill sizes and five speeds. . . . Highway Safety Appliances, Inc, St. Paul, Minn., has designed a **road sander** unit with twin grit hoppers operated by solenoid valves from the dashboard. . . . Ingersoll-Rand Co, 11 Broadway, New York 4, N. Y., is announcing the 8U **impact tool** for running and removing nuts up to 5/8-in. thread size, which weighs 9 lb, 13 oz and operates on a-c or d-c 110/220 v.

Ripley Co, Inc, Middletown, Conn., has developed a **burglar alarm** that operates by a change in light level of the pre-set modulated frequency and is said to be effective for more than 250 ft. . . . Eutectic Welding Alloys Corp. 40 Worth St, New York 13, N. Y., is offering Eutecrod 1700 high **silver alloy** for welding stainless steel, copper, brass, bronze, tungsten carbide and steel. . . . Radio City Products Co, Inc. 152 W. 25th St, New York 1, N. Y., has brought out their Servishop Model 8573 **service instrument** which includes a tube tester and 50 instrument ranges.

Neoline, Inc, 124 W. 4th St, Los Angeles, Cal., has No. 352 **streamer,** said to be waterproof, shockproof, crushproof and weatherproof, for large-scale outdoor lighting installations in lengths up to 2,500 ft . . . Independent Pneumatic Tool Co. 175 State St. Aurora, Ill., has announced a 70-lb, 24-in pneumatic Thor **paving breaker** which is classed just under heavy duty. . . .

American Anode, Inc. 60 Cherry St. Akron, Ohio, will market a **latex compound** called Anodex HR which is said to impart characteristics of high heat resistance (400 F), high elongation (1,000%) and high tensile strength (up to 2,500 psi) to articles dipped, sprayed or brushed with it. . . . Amplex Corp. 728 Atlantic Ave, Brooklyn 17, N. Y., produces the Par-38 **color clip** and 17 color filters for use on Par-38 spotlight or floodlight reflector lamps.

Chain Belt Co, Baldwin-Duckworth Division, 369 Plainfield St. Springfield 2, Mass., manufactures adjustable Baldwin-Rex **chain vises** for simplifying the process of taking roller chain apart. . . . Ideal Industries, Inc, Sycamore, Ill., announces a light duty 8½-lb **air cleaner** that vacuums, blows, sprays or dries, with an air velocity at the blowing nozzle of 18,000 fpm and suction air volume (1½-in. hose) of 120 cu ft per min, powered by a 115-v, universal motor.

Only *Smithcraft* Eye-Q has

these outstanding *Selling* features

"IT'S SIMPLE TO INSTALL"
"IT'S SIMPLER TO CLEAN"
"LOUVERS HINGE FROM EITHER SIDE AND CAN BE COMPLETELY REMOVED"
"IT'S SAFE — NO GLASS OR PLASTIC PARTS TO BREAK"
"EXCEPTIONALLY HIGH EFFICIENCY- 83% HIGH LIGHT OUTPUT WITH UNIFORM LOW BRIGHTNESS"
"YOU'RE RIGHT, AND LOOK AT THE SMART STYLING AND DESIGN"
"THOSE LO-BRITE LOUVERS MINIMIZE GLARE FOR COOL, COMFORTABLE LIGHT"
"EYE-Q IS UNBELIEVABLY LOW IN COST. YET CONFORMS TO THE HIGHEST CONSTRUCTION STANDARDS"
"YOU KNOW EYE-Q CAN BE MOUNTED IN ANY NUMBER OF WAYS"
"RIGHT, AND EITHER INDIVIDUALLY OR IN CONTINUOUS ROWS"

Eye-Q, for 2 40-watt lamps, combines every essential factor from economy to efficiency that must be an integral part of the right fixture for schools, stores, offices and buildings. It is one of many Smithcraft Fluorescent units designed to meet your lighting requirements.

Smithcraft
LIGHTING DIVISION
CHELSEA 50, MASSACHUSETTS

NEWS ABOUT PEOPLE

Indiana Utility Elects Brown and Graham V-Ps

Announcement has been made by the Southern Indiana Gas & Electric Co, Evansville, of the election of two new

A. B. BROWN

vice-presidents, A. B. Brown, vice-president and operating manager, and C. K. Graham, vice-president and commercial manager.

Mr Brown has been identified with the Southern Indiana utility for 23 years and has served as general superinten-

C. K. GRAHAM

dent of the gas and electric operations since 1943. He was formerly identified with the Ohio Edison Co and earlier in his career with the Westinghouse Electric Corp.

In 1930 Mr Graham was placed in charge of the company's commercial and sales activities. His early experience was obtained with the Springfield (O.) Light, Heat & Power Co, now a part of Ohio Edison. Mr Graham is a past-president of the Indiana Electric Association.

William B. Tippy, vice-president of the Commonwealth & Southern Corp, New York, has resigned as vice-president of Southern Indiana.

•

W. H. Jones, division superintendent of the Philadelphia Electric Co at Morton, Pa., has been named purchasing agent for the utility. Mr Jones has been connected with Philadelphia Electric since 1926.

B. H. Fuqua has joined Florida Power & Light Co as an administrative assistant to the vice-president. Mr Fuqua will handle special assignments in connection with the company's commercial activities, with headquarters in Miami. He was financial secretary to the Manatee County Commission from 1933-1936 and in 1937 was elected to the legislature from Manatee County. In 1947 he was appointed executive assistant to Governor Caldwell.

Lloyd Henley of Fresno, Calif., has retired as commercial manager of the San Joaquin power division of the Pacific Gas & Electric Co. He had been with PG&E for 28 years, and was formerly on the staff of the California Railroad Commission.

James P. Sexton, construction engineer, has retired after completing 46 years of service with the Arizona Edison Co. Mr Sexton played a major role in the development of the company's properties.

H. E. Lordley, assistant chief engineer of the Bureau of Water and Electricity of the Richmond (Va.) Department of Public Utilities, has been named assistant director of the department. Mr Lordley has been a member of the department since 1936.

Cecil M. Likens, assistant engineer of the Kendallville (Ind.) light and water department plant for the past 14 years, has been appointed chief engineer, succeeding **Don Deibele,** resigned. Mr Deibele has taken a similar position in Garrett, Ind.

McWhorter Elected Head of National Rural Group

Clark McWhorter, a director of the Southwest Rural Electric Cooperative of Tipton, Okla., was elected president of the National Rural Electric Cooperative Association at the meeting held last week in New York. An original incorporator of the co-op, which was organized in 1937-38, Mr McWhorter served as its manager from 1942-48 and also as a director for one year.

He is also on the board of the Oklahoma statewide cooperative and is a member of its executive committee. He is also a member of the Advisory Power

CLARK McWHORTER

Committee of the Southwest, which functions with the Southwest Power Pool.

An active figure in the affairs of NRECA, Mr McWhorter has been a director of that association for five years and has served on its executive committee for two years.

Before his affiliation with the Tipton co-op, he was superintendent of schools at Arapaho, Okla.

•

Harry E. Wulfing, system planning engineer of the Commonwealth Edison Co, Chicago, has retired after completing 40 consecutive years of service. Mr Wulfing was employed in 1909 as superintendent of outside plant by the Cosmopolitan Electric Co, later consolidated with Commonwealth Edison. He subsequently became superintendent of overhead lines, engineer of a-c sub-

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Some types still short, but over-all stocks in 13 Ryerson plants are probably the nation's largest.

Prompt personal steel service on all orders, large or small, is a Ryerson tradition.

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BARS—carbon & alloy, hot rolled & cold finished
STRUCTURALS—channels, angles, I & H beams, etc.
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SHEETS—hot & cold rolled, many types & coatings
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STAINLESS—Allegheny metal sheets, plates, bars, tubes, pipe, etc.
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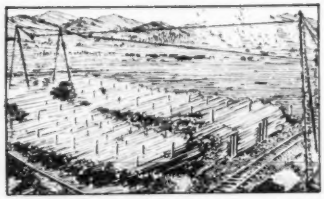

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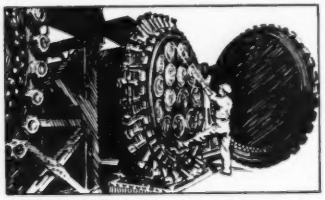

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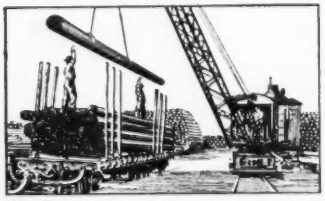

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stations, staff engineer, and system planning engineer. During his long utility career Mr Wulfing participated in the development of many new engineering techniques, among these being the remote control substation.

•

New Appointments Made by General Electric Co

Operations of the wire and cable divisions of the apparatus and construction materials departments of General Electric have been consolidated. Overall responsibility for that portion of wire and cable business formerly assigned to the apparatus department, Schenectady, has been transferred to the construction materials department, with headquarters at Bridgeport, Conn.

B. F. Ilsley, heretofore manager of the apparatus wire and cable division, has been named manager of the expanded wire and cable division with responsibility for all operations, including engineering, manufacturing, and sales. He has been identified with GE since 1929.

J. S. Overstreet, R. P. Allison, C. O. Hull, and **V. A. Sheals** have been appointed to new positions in the division. Mr Overstreet has been made manager of sales; Mr Allison manager of manufacturing; Mr Hull manager of Bridgeport engineering, and Mr Sheals manager of Schenectady engineering.

T. R. Hancock has been appointed manager, marketing research division, construction materials department. He joined GE in 1946.

Dr Harry F. Miller has been appointed engineer of the Pittsfield Works Laboratory, GE transformer and allied products divisions. He succeeds **A. McK. Gifford,** who has retired after 45 years of service. Dr Miller joined GE in 1936 at the Pittsfield apparatus works laboratory. In 1941 he assumed charge of the chemical section, becoming assistant engineer of the laboratory last year.

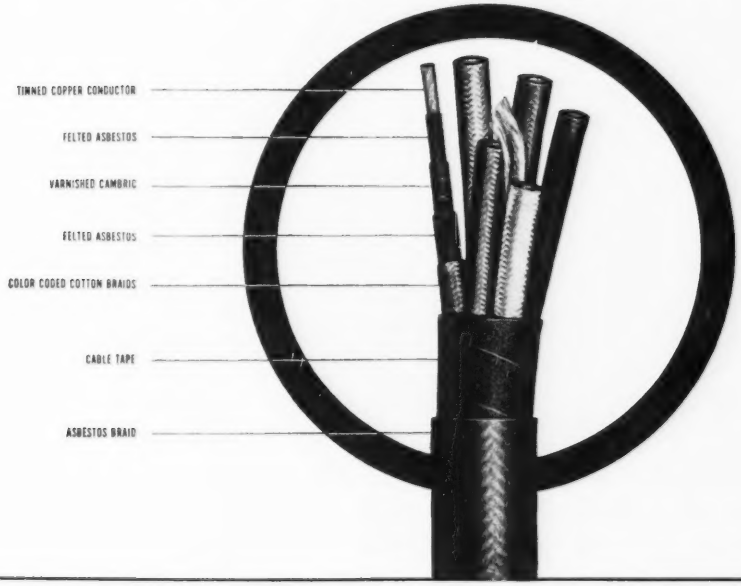
Arthur H. Hemker has been appointed manager of the company's farm industry division. Mr Hemker was formerly in charge of product development for the farm industry division.

T. C. Glenn has been appointed manager of the engineering division of the company's newly-created Michigan District. Mr Glenn has been connected with GE since 1923. He was serving as engineer of the Detroit office at the time of his recent appointment.

•

J. Coleman Jones, superintendent of transmission of Florida Power & Light Co. Miami, has resigned to become assistant general superintendent of Pacific Power & Light Co, Portland, Ore. Mr Jones has been with the com-

This Just Goes to Show...
with cable, it isn't the cost
—it's the upkeep!



An Eastern Electric Utility used single conductor ROCKBESTOS AVC Wires and Cables for years.

But for "economy" they had been using ordinary low temperature control cable in their generating stations on vital control circuits to main steam boilers — burner tilt mechanisms and main power valves.

These circuits are close to steam lines — where it's hot! *Ordinary* control cables didn't stand up.

Convinced that ROCKBESTOS AVC . . . *Asbestos-Varnished-Cambric* . . . Permanent Insulation pays for itself in longer life, less maintenance and fewer outages, the Company has now replaced the ordinary control cable in this hot spot with ROCKBESTOS Table MD AVC Control Cable.

It will pay *YOU* to know the ROCKBESTOS story! Write.

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PITTSBURGH ST. LOUIS LOS ANGELES OAKLAND, CAL.

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We put a lot of careful workmanship into the production of all Sherman Soldering Lugs. Dimensions are held to consistent accuracy. Lugs are kept free from burrs, corrosion, etc., and special attention is devoted to maintaining FLAT contact surfaces. All lugs individually inspected before shipment.

H. B. SHERMAN MFG. CO.
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Sherman
SOLDERING LUGS

Serving the utilities for a quarter of a century

SUPERIOR

Quality Meter Testing and installation equipment

- Test Blocks
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- Safety Blocks
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- Reactiformers
- Transformer Enclosures
- Accessories

SUPERIOR SWITCHBOARD & DEVICES CO.

CANTON 1, OHIO A subsidiary of The Union Metal Manufacturing Company

pany since 1926, when he started as a transmission engineer. In 1935 he was made superintendent of transmission. Prior to 1926 he was identified with the Texas Power & Light Co.

•

New Appointments Made by Sylvania Electric

Two new assignments have been made to the staff of the metallurgical research laboratories of Sylvania Electric Products Inc, New York—**Dr J. R. Dedrick**, formerly associate professor of powder metallurgy at the University of Cincinnati, and **Dr H. B. Alexander**, formerly professor of metallurgy at the Carnegie Institute of Technology. Dr Dedrick will have charge of the group doing work of a research nature but dealing with problems important to commercial products. Dr Alexander will head a group of scientists engaged in fundamental studies of the physics of metals which are important to the performance of incandescent and fluorescent lamps and of radio and electronic tubes.

Samuel B. Williams has been appointed manager of public relations. Mr Williams became identified with Sylvania in 1947 as manager of customer relations. His previous experience covered a number of years in the publishing field where he edited several electrical publications. He served as editor of ELECTRICAL WORLD from 1938 until he joined Sylvania. Mr Williams is a past-president of the Illuminating Engineering Society.

Terry P. Cunningham is made director of advertising and sales promotion. Mr Cunningham will direct advertising and sales promotion for the lighting fixture, lamp, radio tube, and electronics divisions and the Wabash Corp. He was formerly advertising manager of the radio tube, electronics, and international divisions, and has been associated with Sylvania and subsidiaries since 1942.

•

R. R. Brown has been appointed sales manager of Electromaster Inc, Mount Clemens, Mich. Mr Brown has engaged in sales work for Electromaster for 15 years. He was named district manager for the Illinois territory in 1934. During the war years he was the company's sales-contact representative to the Navy for electric range installations. Immediately after the war, he was made director of distribution.

Frank E. Reeves has joined the engineering house of Fay, Spofford & Thorndike, Boston, as electrical design engineer. He has been assigned to the Alaska Project, with headquarters at 55 Tremount St, Boston. Mr Reeves be-

We hog-tied our foreman

Molding technique for Plaskon Alkyd Molding Materials requires relatively high speed presses because Alkyds are extremely fast curing.

Alkyds are especially valuable in electrical applications, because of their low-loss properties, high heat resistance, low moisture absorption, and excellent dimensional stability.

Insulation has a number of presses converted for production with this material . . . but we had to hog-tie our foreman . . . as the process for molding this material was diametrically opposed to our usual molding procedure.

Insulation meets competition with speed and an engineering ability with Alkyds that guarantees a lower cost per unit.

Call us for dependable advice and quotations for molding your product with Alkyds.

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Custom Molders of Plastics for Industry
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Read the latest on fly-ash COLLECTION

that ol' debbil

fly ash and how to trap it is the subject of Buell's 32-page catalog on fly-ash collection. It tells you why only Buell offers you a *fractional* efficiency guarantee. It's the only kind of guarantee that *accurately* and *reliably* predicts fly-ash collector performance. The performance figures are often surprisingly high, for the Buell system has the patented van Tongeren 'shave-off'. It's an efficiency 'plus' found only in Buell's large diameter, non-clogging cyclones. Don't miss this factual booklet on planning fly-ash collection installations. Write today to the Buell Engineering Company, 70 Pine St., Suite 4900, New York 5, N. Y.

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Miller ChemCord Belts have been developed to provide certain safety to workers in the chemical and petroleum industries. ChemCord is a highly flexible webbing that to a large extent resists the effects of acids, fumes and smokes containing acids, as well as water high in mineral content.

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I am interested in the above equipment. Please send additional information and Mike, too.

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Attach coupon to your letterhead and get Mike, Miller's trademark reproduced in colorful plastic. Mike watches quality, service, and price — make him your safety club representative.

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EQUIPMENT CO., INC.

FRANKLIN, PENNA.

came a staff member of the Boston Edison laboratory in 1925. In 1944 he was appointed electrical engineer of the Electrical Apparatus Co, Boston. In his new position he has charge of electrical power plant design.

Edward R. Taylor, merchandising manager, Hotpoint, Inc, Chicago, has been named manager of market development and **John E. Bogan** has been appointed to fill the merchandising position. Before going to Hotpoint as merchandising manager in 1947, Mr Taylor headed similar functions for a Chicago radio manufacturer. Previously he had been with advertising agencies and manufacturing companies in the automotive industry in Detroit. Formerly national sales consultant to the American Gas Association, Mr Bogan recently headed marketing for a Midwest range manufacturer.

James L. Woodress, director of sales and assistant secretary, Century Electric Co, St. Louis, has retired. Mr Woodress had been associated with the company for 43 years.

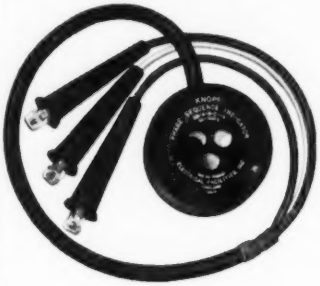
Dr A. V. Astin, formerly assistant chief of the electronics division of the National Bureau of Standards, has succeeded the late Harry Diamond, who had been chief of this division. Dr Astin was one of the original group of scientists assembled at the Bureau in 1940 to develop proximity fuses for bombs and rockets.

W. C. Lyon has been appointed head of the patent department of Cutler-Hammer, Inc, Milwaukee, to succeed **F. H. Hubbard.** Mr Hubbard, who has been with Cutler-Hammer since 1907, will continue to serve the company in an advisory capacity.

Walter A. Buck has been elected operating vice-president of the RCA Victor Division, Radio Corp of America. A retired Rear-Admiral of the U. S. Navy, Mr Buck has served since early last year as president of Radiomarine Corp of America, a service of RCA.

James Lightbody, publications department manager of the B. C. Electric Railway Co, Vancouver, was recently awarded the 1948 silver medal of the Association of Canadian Advertisers, Inc.

James W. Moran has been elected president of the Baker-Raulang Co, Cleveland. He succeeds **E. J. Bartlett,** who becomes president emeritus and continues as a director. Mr Moran joined the company in 1911 and after serving successively in the service, purchasing, and accounting departments,



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Knopp Phase

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All over the U. S. men-in-the-know prefer the Knopp Phase Sequence Indicator. It saves time.

Just clip it on, push the safety button and determine beyond a doubt whether the phase sequence is A-B-C; or C-B-A. This positive Knopp Phase Sequence Indicator has nothing for you to change or adjust for readings. No misleading lamps or dials. It does protect equipment and assure properly connected polyphase wiring; 50 to 500 volts, 3 phase, 3 wire, 25-60 cycles.

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It stands up under rough field use and gives accurate and reliable service. It is made by Electrical Facilities Inc., technical electric equipment manufacturers of 21 years experience. *This* indicator has a *laminated* bakelite housing and no exposed metal parts. It is built for *complete* safety. Fully insulated clips can remain attached between test as safety push button permits indication only when needed. Weighing but 21 oz., the Knopp Phase Sequence Indicator is small and easy to carry. Price $25; with leather carrying case, $30. Order today or write for complete description.

ELECTRICAL FACILITIES INC.

4236 Holden Street Oakland 8, Calif.

was made auditor in 1916. Four years later he was elected assistant treasurer and in 1934 secretary, treasurer, and director. Mr Bartlett began a 37-year period of service in 1911, became assistant general manager in 1913, vice-president and general manager in 1919, and then assumed the duties of president in 1925.

E. J. McFadden has been appointed general sales manager of the water heater, range boiler, and soil pipe department of Combustion-Engineering-Superheater, Inc, New York. Mr McFadden's experience has included Government service (U. S. Department of Commerce), advertising agency work, editorial work on a trade publication, and advertising and sales promotion for General Electric Co. Following discharge from military service in 1945, he returned to General Electric and was made sales manager of the water heater division. Mr McFadden will make his headquarters at the company's plant in Chattanooga, Tenn.

Charles S. Lumley has been appointed executive vice-president and director of engineering of the H. E. Beyster Corp, architects and engineers, Detroit. Mr Lumley has had wide experience as a professional engineer and administrator, both abroad and in the United States. He brings to the Beyster organization a background of 30 years of industrial experience supplemented by his production accomplishments while general manager of Roller-Smith, Bethlehem, Pa., during the war years, and his association with Smith, Hinchman & Grylls, Inc, Detroit engineers and architects, as chief engineer of the industrial division.

F. M. Sparling, assistant chief engineer for the Arkansas Public Service Commission, has resigned to become division manager of the Oklahoma properties of the Southwestern States Telephone Co.

OBITUARY

John F. Kelly, Jr. export sales manager of the Electric Storage Battery Co, Philadelphia, for the past 24 years, died on Jan 25 in Newark, N. J. He was 57 years old. Mr Kelly had been identified with the Electric Storage Battery organization for 40 years.

Charles H. Eames, 74, president emeritus of the Lowell Textile Institute, died at Billerica, Mass., on Jan 29. In his earlier career he was connected with the Milford (Mass.) Light & Power Co and with the engineering department of Stone & Webster, Boston. He retired from the Lowell Institute in 1945 after 38 years of leadership.

Accommodates a Broad Range of Cable Sizes
Gets the Job Done Faster . . . Easier!

Frankel Split Bolt Connectors are easy to use on all types of connections, whether temporary or permanent. A proven favorite for taps, dead ends, motor leads, and in junction boxes, etc. For working in close quarters or mean spots, you can't find a better connector than a Frankel "Bug."

• *compare these advantages!*

1. Extra length pressure bar extending beyond nut, keeps threads firmly meshed, prevents stripping.
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3. No sharp edges to nick wires.
4. All material guaranteed against season cracking.
5. Nut of high strength Duronze.
6. Pressure Bar is a bronze forging.
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KEEP FRANKEL "BUGS" HANDY — YOU'LL USE THEM EVERY DAY

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42 YEARS OF KNOW-HOW IN SOLDERLESS CONNECTORS

MANUFACTURERS and MARKETS

AUXILIARY GENERATORS of the A. B. Chance Co's power control unit supply power for much needed heat in the homes of Centralia, Mo., during the town's most severe ice storm in twelve years. The generator set is normally used to supply power for controls and lighting for the Chance mobile test laboratory. It can be tapped directly for 100 and 220-volt single-phase loads for emergency use

Study Third B.C. Aluminum Unit; Reject Quebec Plan

Announcement has just been made that a third aluminum company is now interested in the development of hydroelectric power in British Columbia. Engineers for the Aluminum Co of America are now making surveys of the water reserves in the far northern section of that province. The company would like to build its aluminum reduction plant at Skagway on the American side of the Alaska border and use British Columbia power for its operations.

The two other companies, Aluminum Co of Canada and Reynolds Metal Co, who have both announced they would like to set up plants on the coast, have indicated that they would be completely British Columbia operations. Both would use power from the coast's huge watershed, and both would build their plants and townsites in B. C.

Alcoa, however, has been eyeing the huge reservoir of waterpower in the Atlin Lake district, which, it is estimated, would provide one of the largest and most economical sources of electric potential on the continent. Engineers have estimated that power from this watershed would be well over 1,000,000 hp, and could possibly climb to nearly 2,000,000, if utilized completely.

A new development occurred in the Canadian aluminum situation when Premier Duplessis announced last week that the Quebec government has decided against a plan for diversion of the Bersimis River to increase the electric power resources of the Aluminum Co of Canada. The premier said that the decision had been made on the basis of a report by A. B. Normandin, technical adviser to the government on hydroelectric resources.

Premier Duplessis said that late last year officials of Alcan made the proposal to overcome electricity shortage at its Arvida, Que., plant by turning the waters of the Bersimis on the St. Lawrence north shore in Saguenay district into the Peribonka River. "The report," said Premier Duplessis, "confirmed the opinion we had that the project . . . cannot be recommended and does not conform with the public interest . . ."

•

Lukens to Electrify Mill

Directors of Lukens Steel Co have approved a proposal to electrify its 206-in. mill at an expenditure of $1,715,000.

Appliance Industry Faces Biggest Year, Says Nance

The electric appliance industry faces its biggest year in production and sales, surpassing peak 1948 totals and opening new opportunities for youthful executives, the Milwaukee Junior Chamber of Commerce was told recently by James J. Nance, president of Hotpoint, Inc.

At the Chamber's annual Distinguished Service Award dinner-meeting, the growing number of openings in industry for qualified young men was voiced by Harold W. Story, vice-president, Allis-Chalmers Manufacturing Co, in a brief talk.

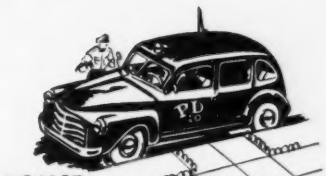
At an informal press conference preceding the meeting, a group of management officials expressed the unified view that all phases of the electric industry were marked for top sales years. In the principal address Mr Nance said that the electric industry is a young man's enterprise. Figures indicating new acceptance for automatic home appliances and heating equipment were cited to show that the industry needs a continuing flow of "young blood" to meet its increasing executive demands.

Mr Nance told a press conference that the company's Milwaukee plant turned out 250,000 dishwashers and electric water heaters. Production at other factories brought the company's total to more than 1,250,000 electric ranges, refrigerators, freezers, washing machines, ironers, dryers, kitchen cabinets, and disposals. Hotpoint plants for all products operated at full capacity during 1948 and would continue on that basis, "as far as we can predict from the present outlook," Mr Nance disclosed.

•

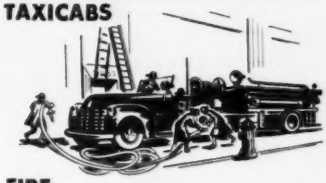
Contract Let on New Alcoa Wire, Cable Plant Site

First step in construction of a new rod, wire, and electrical transmission cable plant to be built at the Vancouver, Wash., works of the Aluminum Co of America was taken in the awarding of a contract for grading of the plant site. Erland & Blickel, Vancouver, received the contract. In addition to manufacturing aluminum transmission cable,

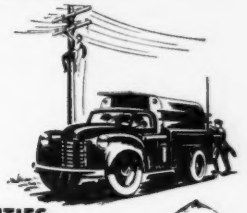


POLICE

TAXICABS



FIRE



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Please send me information about the new PHILCO F-M Radiophone Communications Systems

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Silicone News

DC SILICONES

What's Essential?

Buttons and bows may be essential to the little woman; a box of La Coronas may be essential to us. But that's a purely relative use of the word. For something that is absolutely essential we point to certain industrial motors . . . for example, pump motors that supply water to a processing plant. They're the kind of motors that deserve Silicone Insulation.

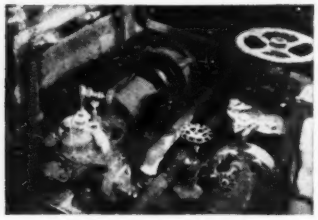

PHOTO COURTESY PURE OIL COMPANY

Both of the 10 h.p. motors which supply water to the Pure Oil Refinery at Midland, Michigan, are silicone insulated to assure continuous operation under adverse conditions.

These two pump motors are located in a subbasement near a river that overflows every spring. Ventilation is poor and humidity is always high. Originally insulated with Class "A" materials, both motors failed the first time they were flooded out. They were then rewound with Silicone (Class "H") Insulation.

Pure Oil specified Silicone Insulation because it offers much more protection to motors exposed to excessive moisture. In several instances, silicone insulated motors that were submerged by flooding have been hosed off and put right back into service. Accelerated life testing and actual performance records have proved that this new class of insulation developed by Dow Corning has at least 10 times the life and 10 times the wet insulation resistance of the best insulating materials previously available.

Electrical maintenance and production men in all fields of industry are learning that Silicone Insulation is the best insurance there is for critical motors. For more information, call our nearest branch office or write for pamphlet No. G7-AB.

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MIDLAND, MICHIGAN

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In Canada: Fiberglas Canada, Ltd., Toronto
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Dow Corning

FIRST IN SILICONES

the new plant will have facilities for producing high-strength aluminum wire and rod products and screw machine stock.

According to Alcoa spokesmen, the plant was located in the Pacific Northwest to be close to markets furnished by the Bonneville Power Administration and the Bureau of Reclamation.

•

Westinghouse Pays $5,085 for Worker's Suggestion

Westinghouse Electric Corp has just paid $5,085 to 58-year-old Aloysious Estadt of the East Pittsburgh plant for a suggestion he made on how mica sheets could be made by machine instead of by hand. The award to Mr Estadt for his 17-word suggestion was the largest paid to any individual in the 39-year history of the company's employee suggestion system. Gwilym A. Price, president, presented the award to Mr Estadt at a dinner held at the plant.

Also honored at the dinner were 111 East Pittsburgh suggesters, who each received payments in 1948 of $50 or more. Last year workers at this plant submitted 11,404 ways to improve the production processes; 5,027 of these ideas were adopted and their originators were granted a total of $57,209.

•

A-C Awarded $4,000,000 Hoover Dam Contract

Allis-Chalmers Manufacturing Co has been awarded a contract totaling more than $4,000,000, by the U. S. Department of Interior, Bureau of Reclamation, covering power generation equipment for Hoover Dam.

The award covers two 115,000 hp, 480-ft head, 180-rpm hydraulic turbines and two 82,500-kva, 16,500-volt generators similar to units previously installed at the same station.

A-C has already supplied seven of the 12 large hydraulic turbines installed at Hoover Dam.

•

Worthington Pump Directs Subsidiary's Activities

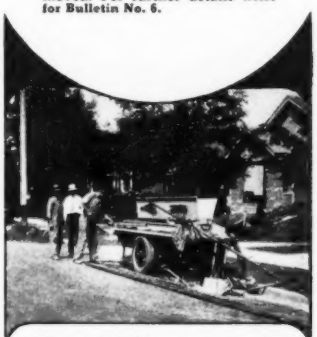
Worthington Pump & Machinery Corp, Harrison, N. J., has announced that the manufacturing and distributing activities of its subsidiary, Ransome Machinery Co, will be conducted by the parent corporation.

Manufacturing operations for the line previously manufactured by Ransome will be carried on at Worthington's Dunellen Works, Dunellen, N. J., the same location formerly used by Ran-

The NEW LITTLEFORD ALL STEEL PORTABLE "HAN DEE BOX"

The Low Cost unit for transporting valuable tools

Here's the Weatherproof, Thiefproof, Fireproof all steel HanDee-Box, the tool box constructed to trail at high speed. In addition the HanDeeBox is sturdily built, light weight and modern in appearance. The HanDeeBox too, has a patented all around locking arrangement, wide working shelves on both sides, partitions and shelves for storing tools. Gas Companies and Contractors will find this HanDee-Box the low cost method for transporting tools to the job, and leaving them overnight without fear of losing them as neither the HanDeeBox or the tools can be removed. For further details write for Bulletin No. 6.



Plenty of working area and tools are available when the Littleford HanDeeBox is on the job.

LB LITTLEFORD

LITTLEFORD BROS. INC.
421 E. Pearl Street, Cincinnati 2, Ohio

some Machinery Co. Sales activities will be directed from Worthington's executive offices at Harrison, N. J., through the Ransome sales division located at the Dunellen Works.

•

GE Suggests Employees Voice Labor Law Views

General Electric Co has announced that it has suggested that its 200,000 employees let their Congressmen know how they feel about any labor law revision.

In company publications distributed to the workers, the company ran a list of 18 questions dealing with labor rights issues precipitated by the Taft-Hartley law. Each question is followed by a box to be checked off, "yes," or "no," by the workers to indicate agreement or disagreement with the principle raised by each question.

At the bottom of the page there is a box with the name, address, and occupation of the worker to be filled in.

•

Manufacturers Make New Sales Assignments

Electrical manufacturing companies have recently made the following appointments to their sales staffs:

Sterling Manufacturing Co. Cleveland, has appointed Charles Segel Co, 143 Newbury St, Boston, representative in the six New England states.

Standard Transformer Co. Warren, Ohio, has appointed the E. G. Norton Co, 121 Clarendon St, Boston, as New England representative.

Curtis Lighting, Inc. Chicago, has appointed Edward I. Creed representative in the Philadelphia area. W. P. O'Reilly will represent the company in the Cleveland area.

Day-Brite Lighting, Inc. St. Louis, has appointed Mathew A. Cabot southern California representative with headquarters in Van Nuys.

Marcus Transformer Co, Inc. Hillside, N. J., has appointed Lew C. Conover, 100-A South 21st St, Philadelphia 3, Pa., territorial representative for eastern Pennsylvania, Delaware, Maryland, Washington, D. C., and south Jersey.

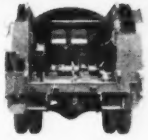
•

Moves to New Quarters

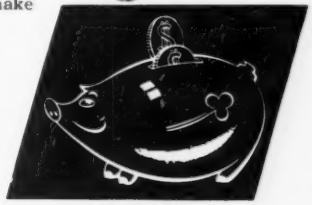
Wheeler Insulated Wire Co, Inc, division of the Sperry Corp, is now located at 150 East Aurora St, Waterbury 91, Conn. Moving into these new quarters has enabled the company to develop and manufacture all its products in one plant. The company was formerly located at Bridgeport.

the SAVINGS in LOWER Maintenance costs by using YORK-HOOVER BODIES is just like EXTRA MONEY in the BANK

Model LCW-102



This light construction body is furnished with complete working equipment. Built in crew compartment provides maximum protection—adequate space is provided for all materials and tools—contributing factors which make the LCW-102 a profitable investment for you.



Write for the LCW-102 "facts" today!

YORK, BODY DIVISION YORK-HOOVER CORPORATION PENNA

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Use fast-working electrical tools on any construction or maintenance job with this high capacity, portable, compact electric plant. Equipped with four-receptacle box for direct plug-in of tools or lights. Available with carrying frame, or dolly-mounted. Powered by Onan 10 HP, two-cylinder, 4-cycle, air-cooled engine. Shipped complete . . . ready to go!

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ONAN AIR-COOLED ENGINES—CK: 2-cylinder opposed, 10 HP. BH: 2-cylinder opposed, 5½ HP. IB: 1-cylinder, 3¼ HP.

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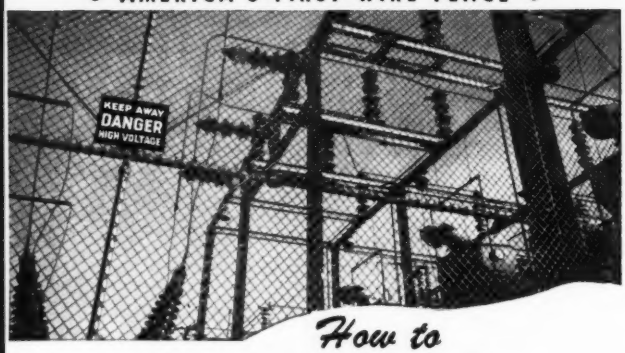

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NEW ELECTRICAL CONSTRUCTION

NEW ELECTRICAL construction projects announced by private and government utility systems involving more than $70,000. Also listed are major industrial and construction jobs where electrical work is included

UTILITIES

Proposed Construction

Arizona and Nevada—Bureau Reclamation, Dpt. Interior, Parker Dam, Calif., constr. Coolidge E. D. No. 5, 115 kilovolt transmission line, Davis Dam Proj., near Eloy, Ariz., Spec. 2545. L. N. McClellan, Bldg. 1-A, Denver Federal Center, Denver, Colo., ch. engr.

Arkansas — Arkansas Power & Light Co., Pine Bluff, 111 mi. rural distr. lines, North Little Rock to Parkin, **$1,600,000.**

Colorado — Bureau Reclamation, Dpt. Interior, Bldg. 1-A, Denver Federal Center, Denver, 750 kva substation at Haxtun. L. N. McClellan, c/o owner, ch. engr.

Colorado — Bureau Reclamation, Dpt. Interior, Bldg. 1-A, Denver Federal Center, Denver, constructing Flatiron-Greeley 115 kilovolt transmission line, Colorado-Big Thompson Proj., Spec. 2551. L. N. McClellan, ch. engr.

Del., Greenwood and Georgetown—Delaware Rural Electric Assn., Greenwood, electric sub-stations, **$350,000.** R. R. Jefferson, c/o owner, mgr.

Illinois—Southeastern Illinois Electric Co-operative, Harrisburg, 457 mi. rural distr. lines, 30 mi. distr. lines, 30 mi. distr. lines, headquarters, two-way radio communication sys. and sys. imprvs., Saline Co. **$1,305,000.**

Ill., Belleville—Illinois Power Co., 135 N. Main St., Decatur, rein.-con. steel, 60,000 kw. power substation, 10 acre site 1 mi. south of city limits, on Ill. Hy. 159. **$1,000,000.**

Ia., Mount Pleasant—City, J. P. Budde, clk., power plant imprvs, incl. power piping and station wiring, Black & Veatch, 4706 Broadway, Kansas City, Zone 2, Mo., engrs.

Kansas — U. S. Eng., 601 Davidson Bldg., Kansas City, Mo., administrative facilities at Kanapolis Dam, incl. administration bldg., residence, sewage and water sys., electrical distr. sys., entrance structure, driveway, etc., Kanapolis Dam site, Smoky Hill River, 18 mi. southeast Ellsworth, Serial No. Eng. 23-028-49-148.

Minn., Milaca — Rural Co-operative Power Assn. of Maple Lake, O. N. Gravgaard, pres., Maple Lake, power generating plant, incl. 2,500 kw. diesel unit, **$500,000.**

Minn., St. Peters—State, Dpt. Admin., P. T. Peterson, dir. Purchases, State Capitol, St. Paul, power plant alterations, State Hospital.

Missouri—Tri County Electric Co-operative, Lancaster, rural distr. lines, Schuyler Co., **$1,150,000.** Stanley Eng. Co., Hershey Bldg., Muscatine, Ia., engr.

Missouri and Iowa — Nodaway-Worth Electric Co-operative, c/o George R. McGuire, Maryville, Mo., 458 mi. rural distr. lines, etc. Nodaway, Worth, Gentry, Holt and Harrison Counties, Missouri, and Taylor, Page and Ringgold Counties, Iowa, $850,000. Frank Horton & Co., Lamar, Mo., engrs.

Neb., Fremont—City, power plant addn. $75,000. George Grabe, Fremont, archt. Lutz & May, Finance Bldg., Kansas City, Mo., consult. engrs.

N. M., Las Cruces—U. S. Eng., P. O. Box 1538, Albuquerque, electrical distr. sys. for missile assembly bldg. (White Sands P. G. 9-97D).

Oregon—Bonneville Power Admin., 729 N. E. Oregon St., Portland, constructing 12,000 kva transformer bank addns. to south McNary substation 2 mi. east of Umatilla, Inv. 4488. Plans deposit $25.

Tex., Dallas—Dallas Power & Light Co., Dallas Power & Light Bldg., substations, transformers, power lines and generating plant enlargement, **$7,180,000.**

Tex., Dallas—Dallas Power & Light Co., Dallas Power & Light Bldg., above-ground poles and lines throughout city, **$400,000.**

Tex., Fort Worth—City, P. Wks. Dpt., Light & Power Div., City Hall, powerlines replacement, repairing and reconditioning, **$150,000.**

Tex., Waxahachie — Texas Power & Light Co., Interurban Bldg., Dallas, power

line reconstr., incl. four 60 ft. towers. **$100,000.**

Virginia—Community Electric Co-operative, Suffolk, 91 mi. rural distr. lines, headquarters facilities, two-way radio communication sys. and sys. imprvs. incl. approx. 15 mi. new tie-lines, Nansemond Co. **$360,000.**

Washington—Bureau Reclamation, Dpt. Interior, Coulee Dam, furnishing, del. f.o.b. cars shipping point or f.o.b. cars Pasco, 2,300 volt switchgear for Burbank Pumping Plant 1, Columbia Basin Proj., Spec. RI-CB7. Plans deposit $2.50.

Washington—Bureau Reclamation, Dpt. Interior, Bldg. 1-A, Denver Federal Center, Denver, Colo., one dry type neutral-grounding reactor for use in neutral of 6,900 volt, 3 phase 60-cycle, 12,500 kva. generator, one indoor type, single throw neutral grounding circuit breaker rated at not less than 15,000 volts for operation in neutral of 6,900 volt, 3 phase, 60 cycle, 12,500 kva. generator for station-service unit LS-3, Grand Coulee Power Plant, Columbia Basin Proj., Spec. 2553.

Low Bidders & Contracts Awarded

Arizona-Nevada—Bureau Reclamation, Dpt. Interior, Bldg. 1-A, Denver Federal Center, Denver, Colo., furnishing del. f.o.b. West Allis, Wis., one 20,000 kva. synchronous condenser with control equip. for Tucson substation, Davis Dam Proj., Spec. 2507, from Allis-Chalmers Mfg. Co., Continental Oil Bldg., Denver, Colo., **$202,962.**

California—Southern California Edison Co., 601 W. 5 St., Los Angeles, hydro-electric power house on San Joaquin River with 84,000 kw. capacity in 2 generating units; 2,100 ft. arch type concrete dam, 228 ft. high, to Bechtel Corp., 220 Montgomery St., San Francisco, and Morrison-Knudsen Co., Crocker First National Bank Bldg., San Francisco. Est. **$19,106,500.**

Ind., Modoc—Indiana Michigan Electric Co., 220 W. Colfax Ave., South Bend, substation. Owner builds. **$190,000.**

Ind., Selma—Indiana Michigan Electric Co. 220 W. Colfax Ave., South Bend, substation. Owner builds. **$190,000.**

Md., Dundalk — Consolidated Gas & Electric Light & Power Co., Lexington Bldg., Baltimore, 58 x 90 x 107 ft. and 74 x 89 x 118 ft. generating station, separate contracts. **$1,268,000.**

Minn., Minneapolis — Northern States Power Co., A. S. Keely, constr. supt. 15 S. 5 St., superstructure, steel, brick power house addn., 25 x 52 x 53 ft. gallery, 62 x 91 x 111 ft. precipitator bldg., 73 x 103 x 107 ft. boiler room, 12 x 37 ft. and 16 x 17 ft. bldgs. 2832-2910 Marshall St. N. E. Owner builds. **$1,200,000.** J. A. York, c/o owner, archt.

Neb., Falls City—City, power bldg. alterations, addnl. generating equip. to Fairbanks-Morse Co., 902 Harney St., Omaha, **$267,343.**

N. Y., Brooklyn — Bd. Transportation, 250 Hudson St., New York, Zone 13, Livonia, Sheepshead and Nostrand, substations for New York City Transit Sys., from Warshaw Constr. Corp., 101 Park Ave., New York, Zone 17, **$475,509.**

Oregon—Bonneville Power Admin., 729 N. E. Oregon St., Portland, furnishing auto transformers, lifting beams, and services of erecting engineer, Inv. 4428, Lane Co., to General Electric Co., Public Service Bldg., Portland, **$727,500.**

INDUSTRIAL, COMMERCIAL & PUBLIC BUILDINGS

Proposed Construction

Conn., Bridgeport — City Bd. Educ., Bridgeport, brick, steel vocational and technical school, **$3,395,000.**

Kan., Kansas City—Colgate-Palmolive Peet Co., 105 Hudson St., Jersey City, N. J., mfg. plant. Over **$2,000,000.**

Low Bidders & Contracts Awarded

Pa., Pittsburgh—U. S. Steel Corp., Koppers Bldg., and Mellon Natl. Bank & Trust Co., 514 Smithfield St., 40 story, bsmnt., 3 sub-bsmnts., brick, stone, steel bank and office bldg., 5 Ave., etc., to Turner Constr. Co., 420 Lexington Ave., New York, N. Y. Est. **$25,000,000.** Bids 1/27.

Tenn., Nashville—Methodist Publishing House, Demonbreun St., 1 story, bsmnt., sub-basmnt., 147x159 ft., steel, concrete printing plant addn., to R. C. Mathews, Third Natl. Bank Bldg., **$1,000,000.** Bids 1/18.

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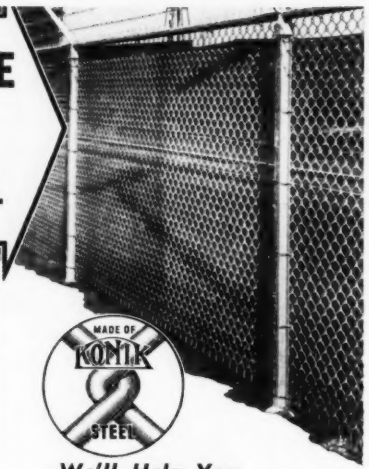

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RECENT RATE CHANGES

CONNECTICUT LIGHT & POWER CO has been authorized by the state Public Utilities Commission to increase its rates by $2,102,000 per year. Of the additional revenue, $1,093,000 is anticipated from electric service, $498,000 from the extension of fuel charges to household rates, and $511,000 from illuminating gas charges. The new rates will become effective after the company has filed suitable schedules and received detailed approval of them.

PENNSYLVANIA WATER & POWER CO has filed with the Federal Power Commission a petition for rehearing on the commission's order dated Jan 5, 1949, calling for a reduction of $1,733,318 annually in prices charged the Consolidated Gas Electric Light & Power Co of Baltimore for electricity. The order of the commission, effective Feb 1, prescribed a rate of return of 5¼% on a specified depreciated original cost of Pennsylvania Water & Power Co's plant investment, plus working capital. Under the commission's order, the reduction would apply as well to three Pennsylvania utilities: Metropolitan Edison Co. $26,094; Phildelphia Electric Co, $114,311. and Pennsylvania Power & Light Co, $80,538. The filing of the petition, the petitioners explained, does not operate as a stay of FPC's order reducing rates, but the company has filed a separate petition to postpone the effective date of the order.

NEW ENGLAND TELEPHONE & TELEGRAPH CO won a significant decision on the responsibility of a commission to issue emergency rate approval when apparently justified. The ruling was handed down by Superior Court Judge G. F. Frost. The company had been denied a request by Public Utility Administrator Thomas A. Kennelly to approve an immediate rate increase of $1,112,000 per year, pending decision in a protracted rate case. Judge Frost issued an injunction, ordering Kennelly to authorize the proposed emergency rates at once. He declared that the company's sworn evidence that it is losing money warranted such action in protection of its constitutional right to protect its property. The company had expressed its willingness to post a bond to guarantee rebates to its subscribers if the new rates are found excessive, which the court held proper on the utility's part.

MISSOURI EDISON CO, Louisana, Mo., has been authorized by the state Public Service Commission to pass along to its commercial and industrial customers any increases in the cost of producing electrical energy. The commission pointed out that the Missouri Edison purchases energy from the Missouri Power & Light Co of Jefferson City and the Union Electric Co of Missouri, St. Louis, under purchase contracts that have fuel adjustment clauses. Under this plan the producing utility passes along to Missouri Edison any increases in the cost of the fuel used in the production of energy.

CITIZENS UTILITIES CO has announced that it will appeal to the State of Vermont Supreme Court a decision of the Vermont Public Service Commission allowing rate increases for the company's Vermont property estimated at $100,000 a year. The company contends that this is about one half the amount asked and is inadequate to permit the company to earn enough to insure successful financing for new facilities.

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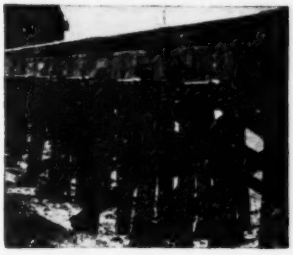

BRIDGES 40 YEARS This is one of several pressure-*creosoted* timber bridges which is still in use after more than 40 years. The resistance of pressure-*creosoted* bridges to decay, year in and year out, assures uninterrupted service and low annual replacement costs.

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Low-Voltage Capacitor Applications

(Continued from page 91)

stalled one might put two 3-kvar capacitors at appropriate places on the secondary of each 25 kva or larger transformer having a power factor of 85% or lower.

Protection

The secondary capacitor is inherently self-protecting for line-to-line lightning surges due to its low reactance at high frequencies (approximately 0.01 ohm at 100 kc). Line-to-ground surges are limited by bushing flash-over, and with only 120 v to ground such flash-overs are self-clearing. Therefore, lightning arresters do not appear to be justified.

Protection of the transformer-secondary from a faulted capacitor may be desirable. Such protection may be obtained by a 50-amp secondary fuse or by making the connections between secondary and capacitor bushings with small tinned copper wire; for example, No. 14 which has a fusing current of about 170 amp in 10 sec ($I^2t = 300{,}000$).

Voltage Rise Computation

When a capacitor is connected to the power system it causes a rise in voltage equal to the product of the capacitor current and the reactance from the capacitor to the generator. Individually, secondary capacitors have little effect on primary voltage but collectively they may cause an appreciable voltage rise. Computation of this voltage rise can be approximated using the "voltage rise" constants given in Table III. The voltage rise occurring in the distribution transformer secondary system is largely controlled by the transformer reactance and is:

$$\text{T Voltage Rise} = \frac{\text{Ckvar}_c \times \text{M ft}}{K_o} + \frac{\text{Ckvar}_t \times \%X}{T}$$

Ckvar$_c$ = Kvar of capacitors on one secondary run
M ft = Length of secondary run from transformer to capacitor — M ft
K_o = Voltage rise constant from Table IV Columns (2) and (3)
Ckvar$_t$ = Total kvar of capacitors supplied through transformer
%X = Percent reactance of transformer on rating base %
T = Size of transformer—rated kva

In this formula the first term is the voltage rise caused by the flow of capacitor current in the secondary conductors, and the second term is the corresponding voltage rise in the transformer.

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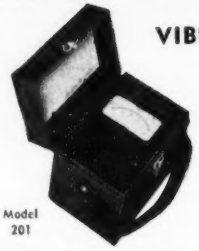

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TECHNICAL LITERATURE

Mechanical Rectifiers — Low voltage power conversion through the medium of mechanical rectifiers is outlined in Bulletin 4809 issued by I-T-E Circuit Breaker Co, 19th and Hamilton St, Philadelphia 30, Pa. Contents include a brief history of the rectifier from its origination by Siemens-Schuckert (Germany), elementary explanation of the theory of mechanical conversion, explanation of the principles of the mechanical rectifier, and diagrams of various phases of operation.

Temperature Measurement — *Master Test Code for Temperature Measurement of Electric Apparatus* has been published for trial use. This Publication 551 has been issued by American Institute of Electrical Engineers, 33 W. 39th St, New York 18, N. Y.

Standards—The 8th edition of *Standards of Hydraulic Institute* consists of six sections: a General Section, a Data Section, a Centrifugal Pump Section, a Rotary Pump Section, a Reciprocating Pump Section, and a Tentative Standards on Pipe Friction. This 8½x11-in. publication may be purchased, at $3 per copy, from Hydraulic Institute, 90 West St, New York 6, N. Y.

Plastics—The 4th edition of *ASTM Standards on Plastics* gives the more than 100 specifications and tests covering a wide range of plastics and related materials. This 610-page book, at $4.50 per copy, can be obtained from American Society for Testing Materials, 1916 Race St, Philadelphia 3, Pa.

Starting Current—*Single-Phase Motor Starting Current Rules* is a report of the Joint Committee on Motor Starting Currents of The Association of Edison Illuminating Companies, 40 W. 40th St, New York, N. Y., Edison Electric Institute, 420 Lexington Ave, New York 17, N. Y. and National Electrical Manufacturers Association, 155 E. 44th St, New York 17, N. Y. The 8-page pamphlet is known as EEI Publication Q-8 and NEMA Publication 116, obtainable from latter two organizations, at 25¢ per copy.

NEMA Standards—An alphabetical listing and a descriptive *Index to NEMA Standards Publications* has been issued by Engineering Department, National Electrical Manufacturers Association, 155 E. 44th St, New York 17, N. Y.

Electron Tubes—The *American Standard Graphical Symbols for Electron Devices* known as Z32.10-1948 covers electron tubes and includes component symbols, typical application of symbols and tube base conventions. Copy of the publication may be obtained from American Institute of Electrical Engineers, 33 W. 39th St, New York 18, N. Y.

Shipboard Installations—*Recommended Practice for Electric Installations on Shipboard* (1948 Revision) have been drawn to serve as a guide for the equipment of merchant vessels. This Publication 45 is available from American Institute of Electrical Engineers, 33 W. 39th St, New York 18, N. Y.

Synthetic Liquid Fuel—*Some Studies of Ohio Coals, Shales and Oils* is a progress report of an investigation to establish the possibility of producing oil from Ohio coal and shale. The report is Bulletin 133 issued, price $1, by Engineering Experiment Station, Ohio State University, Columbus 10, Ohio.

Transformers — *NEMA Standards for Transformers*, Publication 48-132 (supersedes 42-73) includes: EEI-NEMA Fourth Report covering oil-immersed distribution transformers 500 kva and smaller; tables

PAGE
Stainless Steel
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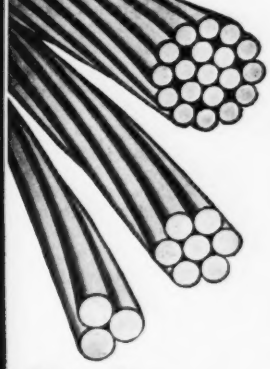

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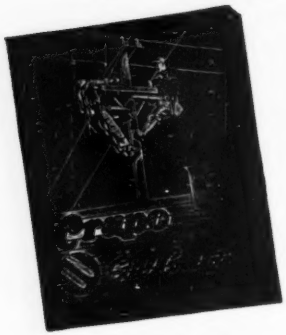

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of recommended accessories; standards for submersible transformers 200 kva and smaller; use of sealed tank construction; new definition covering available methods of oil preservation; and miscellaneous additions and changes to conform to ASA terminology and phrasing. Copies at $4 each may be obtained from National Electrical Manufacturers Association, 155 E. 44th St, New York 17, N. Y.

Arc Welding Electrodes—Four tentative specifications have been prepared for the following arc-welding electrodes: mild steel, low-alloy steel, corrosion-resisting chromium and chromium-nickel steel, and copper and copper alloy. These specifications are available at 25¢ each, from either the American Welding Society, 33 W. 39th St, New York 18, N. Y., or American Society for Testing Materials, 1916 Race St, Philadelphia 3, Pa.

Fence Controllers — Bulletin of Research, No. 40, entitled *The Visual Study of Nonperiodic Electric Transient Phenomena*, reports the technique employed in determining the output characteristics of electric fence controllers. Copies of the bulletin may be obtained by addressing Underwriters' Laboratories, Inc, 207 E. Ohio St, Chicago 11, Ill.

Textile Materials—The 1948 edition of *ASTM Standards on Textile Materials* includes in their latest form 86 specifications, test methods and tolerances for cotton, rayon and silk, wool, asbestos, glass, bast and leaf fibers. The 560-page book, at $4.35 per copy, can be obtained from American Society for Testing Materials, 1916 Race St, Philadelphia 3, Pa.

Chlorine — A chlorine technical data book has been released by Columbia Chemical Division of Pittsburgh Plate Glass Co, Fifth Ave at Bellefield, Pittsburgh 13, Pa. The manual presents charts, diagrams and photographic illustrations concerned with the production and handling of chlorine and several of its end-products.

Air Conditioning—A 6-page booklet *Air Conditioning Design* includes a group of definitions and describes the general procedure for designing an air conditioning system. Copies at 40¢ each may be obtained from American Society of Refrigerating Engineers, 40 W. 40th St, New York 18, N. Y.

Coupling Selector—A slide rule has been developed to determine which Steelflex coupling size (3F to 18F) can be used for an application. The selector will be furnished by The Falk Corp, 3010 W. Canal St, Milwaukee 8, Wis.

Copper—The 1948 *ASTM Standards on Copper and Copper Alloys* is made available, at $4.35 per copy, by American Society for Testing Materials, 1916 Race St, Philadelphia 3, Pa. The 516-page book includes 106 standard specifications, test methods and definitions of terms.

NBS Publications—Circular 460, *Publications of the National Bureau of Standards*, listing all Bureau publications from 1901 to June 30, 1947 has become available, at 75¢ per copy, from the Superintendent of Documents, U. S. Government Printing Office, Washington 25, D. C.

Radioactive Isotopes — Directions for use of radioactive standards and calibrated samples of radioisotopes issued by the National Bureau of Standards are given in a 12-page pamphlet entitled *Measurement of Radioactive Isotopes*. As Circular 473, it can be obtained, at 5¢ per copy, from the Superintendent of Documents, U. S. Government Printing Office, Washington 25, D. C.

Welding—*Fabrication and Welding of Massive Structures* presents factors affecting transition temperature of metals used in huge pressure vessels and welded ships. As TEMPIL TOPICS No. 12, it can be obtained from Tempil Corp, 132 W. 22nd St, New York 11, N. Y.

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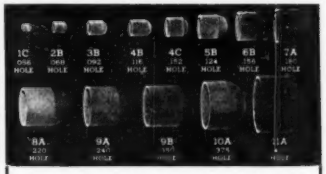

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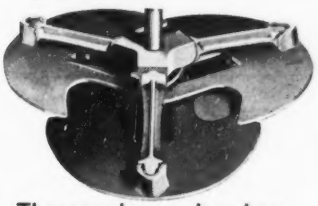

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LETTERS TO THE EDITOR

Note on Technical Notes

To the Editor of ELECTRICAL WORLD:

I would like to add a short supplement to your following note in the December 25th *News Issue* of ELECTRICAL WORLD. "Regulator buck range proves on critical analysis to be superfluous in many instances where specification has been a habit."

I would suggest adding:

".....but regulator buck range costs the regulator manufacturer practically nothing to provide, and costs the user nothing."

G. W. Clothier
Manager
Transformer Section
Allis-Chalmers Manufacturing Co

Tell Them by Radio

To the Editor of ELECTRICAL WORLD:

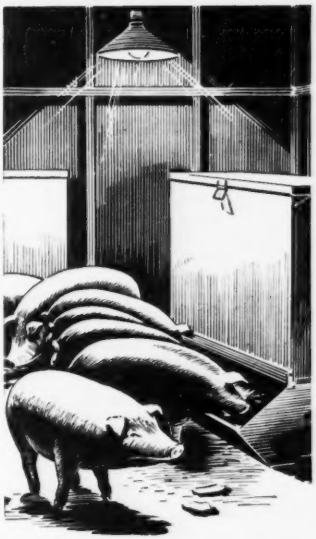
I am very interested in the article in ELECTRICAL WORLD dated December 18, 1948, on the explosion in the Tecumseh Power Station of the Kansas Power and Light Co. with particular reference to the efforts of the company to notify consumers when supply would be restored.

We have similar problems in Ireland but we cannot see any advantage in making radio announcements because 99% of people who hear the announcement already have their supply back and the people we want to inform can't hear the radio programme because they have no supply.

Unless, of course, they have battery sets. But then, in this country, in that case their lights are also battery operated—So what?

R. W. Ryder BE. BSC
Dublin
Ireland

Editor's Note: There aren't many battery sets in Kansas, or anywhere else in the United States, electric service being as inexpensive and as widespread as it is. But there are interconnected systems which can pick up all or part of the load which is dropped as a result of such a disaster. People in Topeka had service for their radios almost as soon as the fire was out. But they didn't have service for their jobs in industrial plants. KP&L used the radio, wisely, we'd say, to let the public know just what happened and what the prospects were for complete restoration of service. According to KP&L officials, public response to the company's problem was excellent.



Midnight snack that pays off in pork chops

FEED hogs at midnight?—One farmer does, and finds it pays. He fills troughs, then wakens swine with floodlights. Soon they are greedily enjoying their "snack." When lights go out, the animals retire—to grow pork chops while they sleep! Odd?—Perhaps; but this is one more example of the uses for electricity on the farm!

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SALARIED PERSONNEL $3,000-$25,000. This confidential service, established 1927, is geared to needs of high grade men who seek a change of connection under conditions assuring, if employed, full protection to present position. Send name and address only for details. Personal consultation invited. Ira Thayer Jennings, Dept. L, 241 Orange St., New Haven, Conn.

POSITIONS WANTED

YOUNG E.E. seeks sales engineering opening. Has degree plus 3 yrs. pwr. plant and refinery elec. design-drafting exp. Also interested in Jr. EE., Engineering Aide, or Safety Engineering openings. Free to travel. PW-7795, Electrical World.

POWER ENGINEER, M.I.T. graduate, Bachelor's and Master's Degree, 12 years experience in all phases steam-electric construction (mechanical and electrical, including administrative experience) in consulting firm, also foundation and structural experience, age 34, desire to change connection. PW-7801, Electrical World.

SELLING OPPORTUNITY WANTED

OLD ESTABLISHED agency desires additional lines including insulators and transformers for Kansas City trade area. RA-7878, Electrical World.

BUSINESS OPPORTUNITY

Consulting Engineer desires partner. Must be Registered Engineer, experienced in power and lighting layouts of all kinds. Must be willing to invest some capital in return for a guaranteed clientele over an agreed break-in period. Established 29 years. Location Connecticut. Object—retirement. BO-7772, Electrical World.

NEW ADVERTISEMENTS

Copy received by February 18th will appear in the February 26th issue.

WANTED

GENERAL MANAGER

Large Canadian Electrical Utility requires General Manager to supervise all operations, including steam and diesel generating stations, transmission and distribution systems. Administrative ability and experience chief qualifications. Up to date knowledge of power industry also desirable.

Apply to

P7819, Electrical World
330 West 42 St., New York 18, N. Y.

GENERAL MANAGER REQUIRED

FOR

SASKATCHEWAN POWER COMMISSION

Position requires full responsibility and authority for all operations. Principal requirements, administrative, engineering or other technical experience in power operation very desirable.

APPLY

SECRETARY
Power Commission,
Regina, Saskatchewan,
Canada.

WANTED

MAINTENANCE AND CONSTRUCTION ENGINEER

With wide experience in maintenance and construction of overhead and underground distribution and transmission lines. Must be capable of assuming full responsibility. Permanent position with large rapidly growing Eastern Utility. Give details of education, experience and salary desired.

P-7701, Electrical World
330 West 42nd Street, New York 18, N. Y.

WANTED

STEAM PLANT SUPERINTENDENT

To operate new 15,000 kw 600 psi 825° F. steam plant near Humboldt, Iowa. To be responsible for operation and maintenance of all plant equipment and personnel. Write giving full particulars of education, experience, references, and salary expected.

CORN BELT POWER COOPERATIVE
Humboldt, Iowa

WANTED

TRANSMISSION SUPERINTENDENT

To operate and supervise 600 miles of new 69 kv transmission line, 30 substations, maintenance crews and equipment. Electrical degree and actual previous transmission and substation experience preferred. Write giving full particulars of education, experience and references.

CORN BELT POWER COOPERATIVE
Humboldt, Iowa

PROTECTION ENGINEER

WANTED

With experience in application and maintenance of transmission, distribution and generating station relaying including fuse coordination. Must be capable of reorganizing and taking complete charge of relay section. Excellent opportunity for permanent position with large growing utility company. Reply giving age, education and experience. All replies confidential.

P 7895 Electrical World
330 West 42nd St., New York 18, N. Y.

MECHANICAL ENGINEERS

For Positions of

Project and Senior Engineers

Steam Power Plant and/or Gas Plant Experience Preferred. Ideal Community—Close to Metropolitan Areas. Write to

Mechanical Engineer
PENNSYLVANIA POWER & LIGHT CO.
Allentown, Pa.

DISTRIBUTOR WANTED

Established national distributor to handle on exclusive basis, Pole Line Hardware for high power transmission lines. This is a highly acceptable product to transmission line authorities.

RW-7876, Electrical World
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SEARCHLIGHT SECTION

TURBO GENERATORS

Item #	Quantity & Capacity	
1049	2000 KW	175# 486° ISP. 2400 volt. CONDENSING. All auxiliaries. 1918. Entirely overhauled and rebuilt 1940. In all critical and moving parts it shows 5 years' normal wear. Heavy 3rd stage wheel installed. Total log record 8 years.
1887	3000 KW	200# 486° ISP. 2400 volt. CONDENSING. All auxiliaries. 1919.
601	2500 KW	230# 550° ISP. 2400 volt. EXTRACTION: 90,000# hr. Max. @ 15#G. Built 1927. Good condition. Some spare blading.
602	2500 KW	230# 650° ISP. 2400 volt. CONDENSING. All auxiliaries. 1934.
1475	4000 KW	600# 750° ISP. 13.8 KV. MAX. THROTTLE FLOW: 85,000# hr. AUTOMATIC CONTROLLED EXTRACTION: 45,000# hr. @ 135#G. (Can modify 125# to 150#) and BACK PRESSURE @ 20#G. (Can modify 15# to 25#). Minimum to exhaust @ max. extraction: 3000# hr. Complete except switchgear. New—never installed — immediate delivery.

BOILERS

1864	700 HP	450# 600° FTT. C.E. Co. Chain grate stoker fired. All controls. 60,000# hr. each.

TRANSFORMERS 1Φ

794	2000 KVA (3)	27 KV Primary. 2300 and 480. Rated 1500 KVA at 2300 and 5000 KVA @ 480.
1814	2000 KVA (2)	23 KV (4-2½% taps above and below) Primary. 2300 Secondary. Less than one year service.

TRANSFORMERS 3Φ

Item #	Quantity & Capacity	
1856	2500 KVA	13.2 KV Primary. 6.6 KV Secondary (with two 10% taps below).
669	2000 KVA (7)	11.5 KV Primary. 480 Y Secondary. Pyranol filled.
1515	7500 KVA (5)	33 KV Zig-Zag Primary. 13.8 KV Secondary (Reconnectable to 6.9 KV).

FURNACE TRANSFORMERS

345	4000 KVA	(3Δ) 24 KV (with 2-10% taps below) Primary. 228.92 (in 12 steps) Secondary. Transformer 5%, Reactor 30% Reactance. Built 1942. Used 2 years.
1521	3000 KVA (6)	(1Δ) 13.2 KV Primary. 240/160 (6 taps) Secondary.
666	8000 KVA (3)	(3Δ) 11 KV Primary. 100/160 Secondary.
673	1000 KVA	(3Δ) 7.2 KV (with 1-10% tap above and 2 below) Primary. 214/125/94 Secondary. 1934.
604	1200 KVA	(3Δ) 12 KV Primary. 190/87 (8 taps) Secondary. 1931.
350	200 KVA	(3Δ) 230 V. Primary. 120/60 Secondary. New.

MOTOR GENERATOR SETS

641	300 KW	250 volt D.C. 2400 volt A.C. 1200 RPM. Rebuilt & Guaranteed.
1415	300 KW	250 volt D.C. 480 volt A.C. 1200 RPM. Rebuilt & Guaranteed.

ROTARIES

801	1500 KVA (2)	275 volt D.C. 13.8 KV A.C.
816	2925/3705	222/285 volt D.C. 13.8 KV A.C. Synchronous booster.

PAUL STEWART
UNION TRUST BUILDING

MAin 5873
MAin 3427
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Meter Department demands are bringing good opportunities to meter experts.
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TEXTOLITE TUBING

Very large quantity offered at low fraction of original cost. Suggest consideration by firms planning to run power cables underground. Light in weight, structurally strong, chemically inert, and with excellent electrical properties. Equivalent Nema Grade XX Rolled Laminate Phenolic Tubing. Manufactured by General Electric for Government, and now unused surplus. Will withstand corrosive waters and atmospheres, chemical salts and solutions, solvents, gasolines, oils, and greases. Length of sections 9' 6". Weight, two pounds per foot. Easily threaded and coupled. Size 4½" I.D. 5" O.D. with ¼" wall thickness. Price and sample section on request. Can thread and couple if required.

Irrigation Division
VEG-ACRE FARMS
Forestdale, Cape Cod, Mass.

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4000 KW TURBINE GENERATING PLANT

Consisting of

1—2000 KW and 2—1000 KW General Electric, 3 phase, 60 cycle, 480 Volts, 3600 R.P.M. Condensing Turbo Generator Units. Complete with all Auxiliaries. General Electric inspection reports are available.

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Motor Generator Sets—3 Ph. 60 Cy.

K.W.	Make	R.P.M.	D.C. Volts	A.C. Volts
1—1800	G.E.	600	125/250	4150
1—1500	G.E.	600	600	2300/4150
1—1500	G.E.	360	275	2300/4600
1—1250	G.E.	600	275	4150
1—1000	Whse.	514	250	4000
1—1000	Whse.	514	250	4000
1— 800(3u)	G.E.	1200	120/240	2300
1— 500	G.E.	720	600	2300/4150
1— 500	G.E.	720	125	2200/4400
2— 400	G.E.	720	250	2300
1— 400	G.E.	1200	120/240	440
1— 350	G.E.	900	125	4150
1— 250	Whse.	1200	250	440
1— 150	Cr. Wh.	1160	250	220/440
1— 100	G.E.	1170	125	220
1— 100	G.E.	1200	250	2200

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Power Equipment

Released by Utilities & Industrials

Turbines, Generators, Steam and Oil Engines, Boilers, Motor Generators, Rotaries, Transformers, Motors, Compressors, Induction Voltage Regulators, Oil Circuit Breakers, etc.

Service backed by 40 years' experience

BREW, WOLTMAN & CO.
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IN STOCK—IMMEDIATE SHIPMENT

2—1420 KVA—FAIRBANKS MORSE—NEW ALTERNATORS DIRECT CONNECTED TO FAIRBANKS MORSE MODEL 38D8-1/8 1600 HP—720 RPM—DIESEL ENGINES.

2—1250 KVA—CROCKER WHEELER—NEW ALTERNATORS DIRECT CONNECTED TO FAIRBANKS MORSE MODEL 38D8-1/8 1600 HP—720 RPM—DIESEL ENGINES.

2— 620 KW—240 VOLT—DC GENERAL ELECTRIC GENERATORS DIRECT CONNECTED TO ALCO TYPE 6—12½ X 13-T 900 HP—700 RPM DIESEL ENGINES.

ENGINES NEW LATE 1944—RELATIVELY FEW HOURS OPERATION

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that other readers can use, advertise it in the

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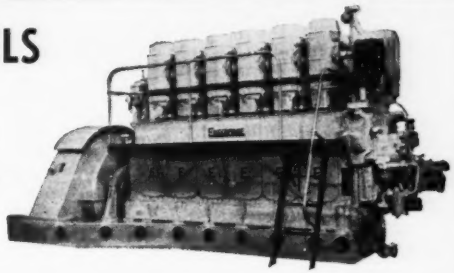
WITH 300 KW IDEAL A.C. GENERATORS

FOR

IMMEDIATE DELIVERY



OTHER DIESELS AVAILABLE
UNIT CAPACITIES—10 TO 1420 KVA
A.C.—50 AND 60 CYCLES

A PARTIAL LIST OF OUR INVENTORY

KVA	Make	Model	HP	RPM	KVA	Make	Model	HP	RPM
1420	Fairbanks Morse	38D8⅛	1600	720	312	General Motors	8-268A	450	1200
1250	General Motors	16-278A	1600	720	300	Fairbanks Morse	YVA	360	257
900	General Motors	12-567	1080	720	200	Buckeye	80	240	600
625	Superior	OS	750	327	125	General Motors	3-268A	150	1200
425	Baldwin	VO-6	510	450	75	General Motors	6016-E	90	1200
375	Enterprise	DSG-6	450	450	62	Int'l Harvester	UD-18	76	1200

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A. G. SCHOONMAKER Company, Inc.

Diesel Engines • Power Machinery

ESTABLISHED 1895

ENGINE DIVISION, 50 CHURCH STREET, NEW YORK 7, N. Y.

TRANSFORMERS

FOR SALE

20—1½ KVA G-E 120/240/480—120/240 DRY
40—10 KVA A-Ch 450/225—117/234 DRY
10—10 KVA A-Ch 460/230—230/115 DRY
20—15 KVA A-Ch 450/225—117/234 DRY
9—15 KVA A-Ch 460/230—230/115 DRY
15—20 KVA W-H 450/225—117/234 DRY
12—20 KVA W-H 460/230—230/115 DRY
6—25 KVA W-H 450/225—117/234 DRY
6—26 KVA W-H 460/230—230/115 DRY
3—75 KVA W-H 230/460—115/230 DRY
6—25 KVA W-H 13200—120/240
9—37½ KVA W-H 13200—120/240
3—50 KVA Pitts 26400—2300/4000Y
3—50 KVA G-E 33000—2400/4160Y
3—150 KVA G-E 2300/4000Y—115/230
3—200 KVA W-H 6600/11430Y—2300
3—333 KVA G-E 13800—120/240
1—Gas Fired Recirculating Youngs Bros. DRYING OVEN, 2 Compts., complete with controls.

TRANSFORMERS WANTED

Rewind and repair services on all makes of transformers. One year Guarantee.

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Cincinnati 27, Ohio

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1606 53rd ST. NORTH BERGEN, N. J. N. Y. C. Tel. LOngacre 5-3227 N. J. Tel. UNion 3-7600

MOTOR SQ. CAGE

1—450 HP.—Ridgeway 900 rpm 2200v.
1—125 HP. G.E., 1800 rpm 2300v.
1—100 HP. Whse, 1800 rpm 440v.
1—100 HP. Whse, 1200 rpm 2200-440v.
1— 75 HP. Whse. CS, 1200 rpm, 2200 volts, 3 phase, 60 cycle.
1—75 HP. 1800 rpm Westinghouse, 440 volt.
1—75 HP General Electric Type KT 900 RPM 440 volt.
2—40 HP. G.E., 900 rpm 220v.

MOTORS SLIP RING

1—2500 HP G.E. MT 257 RPM 6600 volt
2— 150 HP G.E. Type IM 450 RPM 440 volt.
1— 100 HP G.E. Type IM 400 RPM 440 volt.
1—100 HP. G.E. 720 rpm 440v, 25 cy. IM.
75 HP. G.E. 1200 rpm 220v, 60 cy. Vert.
60 HP. West. 900 rpm 2200v. 60 cy. Vert.
50 HP. F.&M. 1800 rpm 220v. 60 cy.

MOTORS—D. C. 230 VOLTS

1—125 HP. G.E. 1800 rpm R.C.
1— 75 HP. 865 rpm General Electric.
1— 50 HP. 700 rpm Crocker-Wheeler.

VARIABLE SPEED 220 VOLTS

1—35 HP. 300/1200 rpm Westinghouse.
1—30 HP. 440/1200 rpm General Electric.
2—25 HP. 650/2200 rpm Westinghouse.
4—25 HP. 300/900 rpm Electric Dynamic.
1—55 HP. 500/1500 rpm General Electric.

MOTOR GEN. SETS

1—1000 KW General Electric 600 volt 514 RPM 4000 Volt Syn.
1—500 KW. G.E. 250v 900 rpm 2300v Syn.
1—500 KW. G.E. 575v 900 rpm 2300v Syn.
1—125 KW. Crocker Wheeler 1200 rpm 125v Generator 2200v S.C. Motor.
1—100 KW. Elect. Mach. 1200 rpm 125v Generator 4150 Syn. Motor.

PLATING GENERATORS

1—1½ KW. G.E. 5/8v with sq. cage mt.
1—12 KW. Hansen Van Winkle 24v 1200 rpm.
20 HP. General Electric KF Motor.
1—3000 Amp. Chandeysson, 6/12v 400 rpm Syn. Motor.
1—2500 Amp. ditto.
1—625 KVA West. Reduction Gear Turbo Generator Non-Condensing, 2400v 3 ph 60 cy.

TRANSFORMERS

1—1000 KVA G.E. 3 ph. 4150 volt to 2400 volt.
1—667 KVA G.E., 3 ph., 4150 volt to 2400 volt.
3—333 KVA Westinghouse Type SL 2400v pri 240/480 sec. Inerteen.
3—300 KVA Pitts. 2300v pri. 115/230v sec.
3—300 KVA G.E. type H 2300v pri. 115/230v sec.
3—150 KVA West. 2300 volt Pri. 240/480 sec.
1—150 KVA G.E. 2300v 110-220v.
2—100 KVA type SK, 13,200v primary 250v, secondary single phase.
10—27½ KVA G.E. 1 ph. brand new 440/220v 220-110v.

ALTERNATORS & SYNCH. MOTORS

1—2500 KVA Westinghouse, Syn. condenser, 720 rpm 2200v with D.C. exciter.
1—320 KVA Allis Chalmers, 450 rpm 480v.
1—240 KVA General Electric ATB, 600 rpm 240v with D.C. exciter.
1—225 KVA 514 rpm 600v Westinghouse.
4—200/100 HP. Whse. 720/360 rpm 4150v.
1—200 HP General Electric 257 RPM 440 volt.
1—165 KW. 514 rpm 2200v Electric Machinery.
1—100 HP. G.E. type TS 600 rpm 4400v D.C.
2—150 HP. 360 RPM. Allis Chalmers 2300 volt.

Complete Line of A.C. and D.C. Motors and Generators

FOR SALE

Used D.C. Watthour Meters

G.E. Type C6

IVAN T. JOHNSON CO., INC.
95 Madison Ave. N. Y. 16, N. Y.

FOR SALE—EXCITER

1—100 KW G.E. Exciter, 125 volts, 800 amps., 1200 R.P.M., compound wound driven through a reduction gear by a DeLaval Steam Turbine designed for 150 lb. dry saturated steam and exhaust against 5 lb. g. back pressure. 5400 R.P.M. Exciter, reduction gear and turbine mounted as a unit on a cast iron bed plate.

FS-7839, Electrical World
530 West 42nd Street, New York 18, N. Y.

FOR SALE—Transformers

Line Hardware and Secondary Power Equip.

3—667 KVA Rebuilt GE Transformers, out door, single phase, 60 cycle, 33000 V. primary—440 V. secondary, type H. Form KD. Also new and unused line hardware, secondary power equipment, 3 phase Buss runs, 500000 CM wire, etc.

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BALTIMORE, 31, MD.

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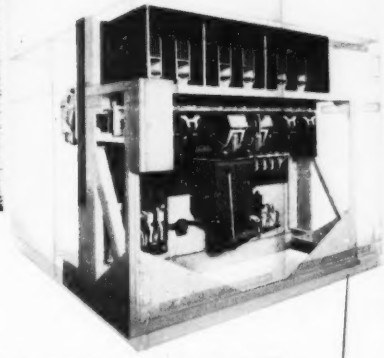
A 6000-AMPERE TRUCK-MOUNTED DRAW-OUT TYPE CIRCUIT BREAKER

for Main-, Bus-Tie-, and Feeder-Breaker Applications

Another I-T-E "first"!



AGAIN I-T-E LEADS the way in Switchgear design! The new I-T-E LG Circuit Breaker is the first 6000-Amp. breaker to be offered in a truck-mounted, draw-out type.

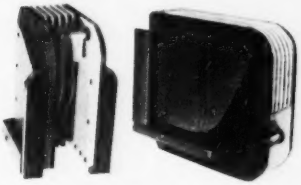
The rugged, heavy-duty Type LG is the ideal breaker for applications where breaker operations are relatively few, and where high interrupting ability — with moderate operating speed — is needed. The LG is designed and built to carry a full load continuously for long periods of time with a minimum of temperature rise.

I-T-E's Truck-Mounted Draw-Out Type LG Circuit Breaker is another example of I-T-E leadership in producing custom-made circuit breakers and switchgear equipment to meet the exacting requirements of individual customers. It is exclusively an I-T-E product — designed and built where Switchgear is a business, not a side line.

The I-T-E representative in your locality will be glad to assist and advise you on adapting the new truck-mounted LG breaker to your electrical distribution system. Use his services without obligation. For complete technical and application data, write for LG (Catalog) 1104.

CONSTRUCTION FEATURES OF THE I-T-E TYPE LG CIRCUIT BREAKER

MAIN CONTACTS are built up of copper bars with silver alloy inserts to provide silver-to-silver contact. Silver facings are durable — more than 40,000 openings and closings do not cause perceptible wear of the contact faces. Intermediate and arcing contacts protect main contacts during opening and closing operations.



ARC CHUTES are magnetic blow-out type. Magnetic vanes, mounted outside the insulating barriers on each side of the contacts, are magnetized upon opening of the intermediate contacts, and the resulting magnetic field forces the arc into the extinguishing chamber. Arcing time is short, arc is completely confined, heavy currents are safely handled in small space.

CONTROL MECHANISM is centrally located. A small door in the main enclosure panel gives access to controls. Actual mechanism is so designed that it automatically locks the truck when in *Disconnected, Test,* or *Operating* position. The truck can be moved to any of these positions without opening the main compartment doors; thus complete protection is given to the operator and the mechanism. An interlocking mechanism prevents the truck from being moved into or out of the operating position unless the breaker has been tripped and all contacts opened.

APPLICATION RATINGS—TYPE LG CIRCUIT BREAKERS

	PANTOGRAPH-MOUNTED	TRUCK-MOUNTED
600 V AC	2000-3000 A	4000-6000 A
250 V DC	2000-5000 A	6000-10,000 A

2-, 3-, and 4-Pole. Electrically operated.
75,000 and 100,000 amperes R.M.S. Interrupting Rating.

I-T-E R&IE *

The Leader In Technical Excellence

I-T-E CIRCUIT BREAKER COMPANY, 19th & HAMILTON STREETS, PHILADELPHIA 30, PA.

31 OFFICES IN UNITED STATES • In Canada, EASTERN POWER DEVICES, Ltd., TORONTO

SWITCHGEAR • UNIT SUBSTATIONS • ISOLATED PHASE BUS STRUCTURES • AUTOMATIC RECLOSING CIRCUIT BREAKERS

*FOR POWER SWITCHING EQUIPMENT, REFER TO RAILWAY AND INDUSTRIAL ENGINEERING CO. ,AN I-T-E ORGANIZATION

CASE STUDY

Annual Savings in Turbine Lubricating Costs with Nonpareil Turbine Oil in a Midwest utility.

Turbine ..... 35,000 KW, 1800 RPM
Oil System Capacity .... 2800 gallons
Operation ... 1931 to 1937 on Turbine Oil X at 45¢ per gallon
Operation ... 1938 to 1948 on Nonpareil Turbine Oil at 87¢ per gallon
Annual Cost of Lubrication with Turbine Oil X $911.57*
Annual Cost of Lubrication with Nonpareil Turbine Oil ... $284.13*
Annual Saving 68.8%

CASE STUDY

Annual Savings in Turbine Lubricating Costs with Nonpareil Turbine Oil on a large utility turbine.

Turbine ..... 80,000 KW, 1800 RPM
Oil System Capacity .... 8,000 gallons
Operation ... Dec. 1935 to April 1942, on Turbine Oil Y at 39¢ per gallon
Operation ... May 1942 to Jan. 1948 on Nonpareil Turbine Oil at 88¢ per gallon
Annual Cost of Turbine Lubrication with Turbine Oil Y $575.30*
Annual Cost of Lubrication with Nonpareil Turbine Oil $503.93*
Annual Saving 12.4%

CASE STUDY

Annual Savings in Turbine Lubricating Costs with Nonpareil Turbine Oil in a Midwest utility system.

Turbine ..... 20,000 KW (Now 30 years old)
Oil System Capacity .... 550 gallons
Operation ... June 1940 to Aug 1944, on Turbine Oil Z at 55¢ per gallon
Operation ... Oct 1944 to Oct 1948 on Nonpareil Turbine Oil at 89½¢ per gallon
Annual Cost of Lubrication with Turbine Oil Z $83.90*
Annual Cost of Lubrication with Nonpareil Turbine Oil $69.49*
Annual Saving 17.2%

*Includes (1) cost of original fill—including interest charges, (2) oil replacements, (3) oil treating or sweetening, (4) cleaning turbine oil systems, (5) filter maintenance (where these items apply).

Turbine lubrication costs CUT... up to 68%

STUDIES have been made of typical utility company operations to determine how much the *price* of turbine oil affects the *cost* of turbine operation. Three such studies are summarized here. In each case, the price of the original fill of oil was 38½ to 55½ *less* than that for Nonpareil. But in each case the total annual cost for lubrication, when all factors are considered, shows a saving with Nonpareil.

You can find out how much Nonpareil will save on your lubricating costs. Standard Oil Lubrication Engineers have facts and figures to help you determine costs of Nonpareil lubrication for comparison with your present costs.

Write Standard Oil Company (Indiana), 910 South Michigan Avenue, Chicago 80, Illinois, to secure the services of the Engineer nearest you.

NONPAREIL
Turbine Oil
"WILL OUTLAST YOUR TURBINE"

STANDARD OIL COMPANY (INDIANA) STANDARD